THE JOURNAL OF ENGINEERING GRAPHICS

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Distinguished Service Award Recipient
EDWARD M. GRISWOLD

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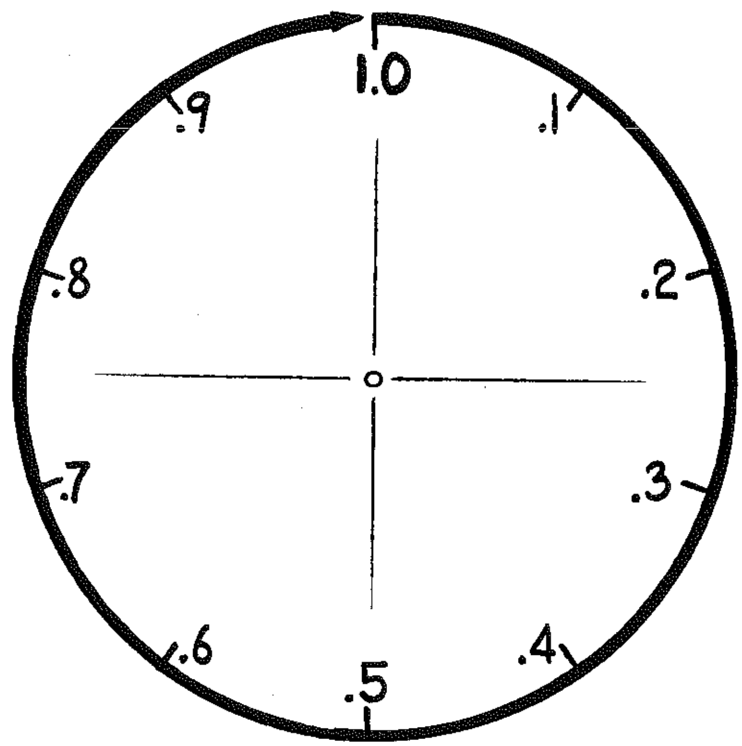

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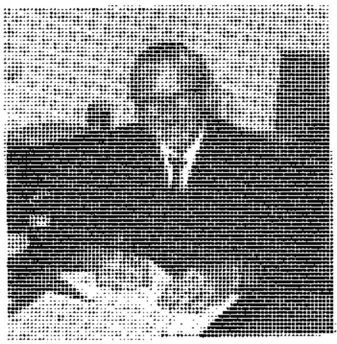


RISE or FALL

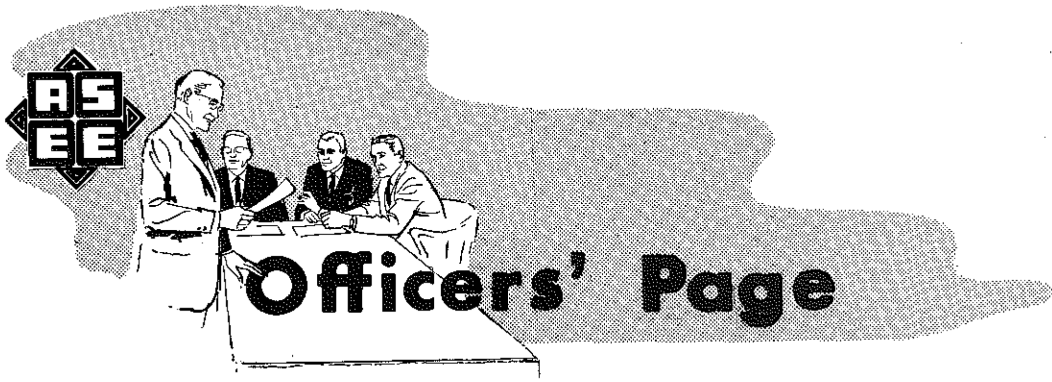
Studies have shown that the greatness of nations have been for an average period of about 200 years. Of course there has been a Rome whose influence lasted for nearly 1000 years, but others have declined in less than 100 years. The United States will be 200 years old in the 1970s; we have been a great nation for more than 100 years. However, articles have been written and speeches have been made telling us that signs are showing up to indicate the beginning of the decline of this great country. No method has yet been mentioned to curtail the decline, in any of these orations or articles, but it is necessary for every one of us to stop for a moment to think. Do we want to remain a part of a great nation or will we be better as a part of one that is not so great? In either case it behooves each and every one to consider our present position as well as our future. We, as educators, must be most concerned since it is our responsibility to prepare young people to take their places in the society of the future.

Can we give up the necessities of the present in favor of those of the future? Will all present needs be scrapped in the future? How can we make an educated estimate of the future requirements? The answers to these and other questions must be found in order to enable our young people to make the transition from today to tomorrow without confusion. It is this confusion that causes decline, unless it is quickly eliminated. We, in engineering education, seem to fear the answers to such questions. We, in engineering education, are more concerned with doing what we like rather than what we should, with the two standard remarks "We don't care what industry wants; they have to take our product" and "Industry doesn't know what they want".

Rather than such an attitude, should we not try to determine the needs for young people to get their start so that they will be in a position to make transitions to the future? Rather than a complacent attitude, should we not help them to develop the means for making that transition? It is a simple task to teach material that have set solutions, but this alone will not help young people to develop creative thinking. It is this creative thinking that will enable them to go from the present to the future without the unnecessary confusion. The material with the definite solutions will help to analyze the feasibility and the validity of the creative thinking, but it is the creativity that brings progress.

There are those who will maintain that to clear up confusion is a "challange" and this causes youngsters to think. Is it a "challange" or is it a "dare"? The prevention of confusion is, in itself a "challange". After the damage is done its rectification often becomes useless. Withou the means for creative development there will eventually be nothing to analyze for useful consumption. Without the need for this analysis it is a waste of time, energy and money to develop these skills.

Therefore, it is the obligation of educators to develop, in our youth, the means for creativeness. In engineering education it becomes the duty of those who are in early contact with engineering aspirants to begin that development. At present, the teaching of the "Design Process" is being refined to enable us to meet our obligation. However, we are being hampered by those who are leaders in the complacent attitute of training glamour operators rather than developers. It seems that it is more important to be expert in such things as computer programming than it is to develop better computation equipment. It seems more important to derive a mathematical equation than it is to use it. It seems more important to discover new phisical phenomena than it is to apply it to practical situations. Is there no room for the designer as well as for the scientific researcher? Are we to train the researcher and not the designer? Can the future be succesfully developed by one without the other? Can the decline of our way of life be prevented by only one group of people or must many groups learn to work together to benefit our civilization?



THE RELEVANCY OF ENGINEERING GRAPHICS

by
James H. Earle
Vice-Chairman
Division of Engineering Graphics, A.S.E.E.

During the past few years, a considerable degree of emphasis has been placed on evaluating the relevance of various courses to the needs of the student and the profession for which he is preparing. This is a positive direction that should be continued in education's attempt to provide the most meaningful programs possible. Programs of engineering graphics have also joined this movement and have studied their offerings to determine the areas of major importance, new areas that should be included, and areas that have lost their importance. Engineering graphics programs that have strived to meet the needs of engineering education have been well received by their major departments for whom they provide service courses.

The future prospects for engineering graphics are excellent when the discipline is presented in a relevant framework. The four most relevant objectives of engineering graphics that seem most compatible with engineering education are: (1) problem solving, (2) engineering design, (3) introduction to engineering, and (4) communication, Figure 1.

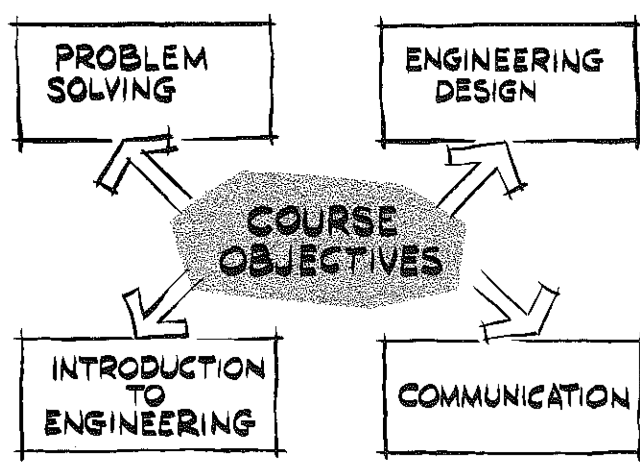


Figure 1

PROBLEM SOLVING

The engineer is a problem solver. He must be well-versed in mathematics, science, and engineering and be able to work in conjunction with members of other professions on complex problems. This theme should be applied to the problems used in graphics courses at the freshman level. All aspects of problem solving should be employed with the engineering problem as the focal point, Figure 2. Where possible meaningful applications should be used to reduce the abstractions which do not stimulate the student's interest. Problems can be selected that require both general and specific applications of graphical problem solving. Skill and technique of work can be emphasized, but this should not be the major consideration.

ENGINEERING DESIGN

Engineering is a creative profession requiring high levels of innovation and imagination. Consequently, engineering design has been recommended as a primary objective of all engineering courses at all levels. The engineering graphics program can offer many contributions to the development of a creative attitude at the most critical stage of the engineer's education --- the freshman year.

All designs must begin with the maximum application of imagination and freedom which are usually applied through sketching and other graphical methods. It is necessary that the engineer be proficient in graphics to enable him to develop his thoughts. The engineering graphics sequence is the most natural area of study at the freshman level to introduce engineering design.

INTRODUCTION TO ENGINEERING

The freshman student can receive an overflow of all areas of engineering through engineering graphics, since problems can be selected that relate to various fields of engineering in conjunction with class discussion of major areas. The role of orientating freshman students to the profession of engineering should be accepted by engineering graphics faculty since they are usually in contact with all students regardless of major. This orientation will assist in holding more students in engineering. He will be more likely to transfer within the college of engineering rather than seeking non-engineering majors if he fully understands engineering and is sufficiently motivated, Figure 3.

COMMUNICATION

The four objectives mentioned here can be achieved in a number of ways by the graphics instructor. However, a proven technique that has yielded favorable results is the use of the comprehensive problems at the freshman level, while working as a member of a team. These problems can encompass a wide variety of graphical applications in a realistic framework.

The student becomes aware of the broad-

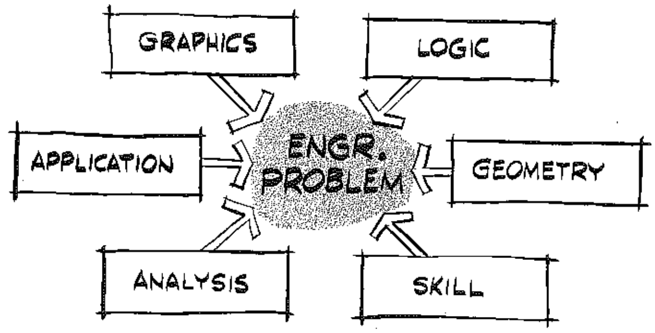


Figure 2

ness of the engineering profession and his function as a member of a technilogical team. Problems are identified, solved, a report written and the results presented orally. The importance of graphics as a relevant tool at each stage of the process becomes evident as the problem progresses.

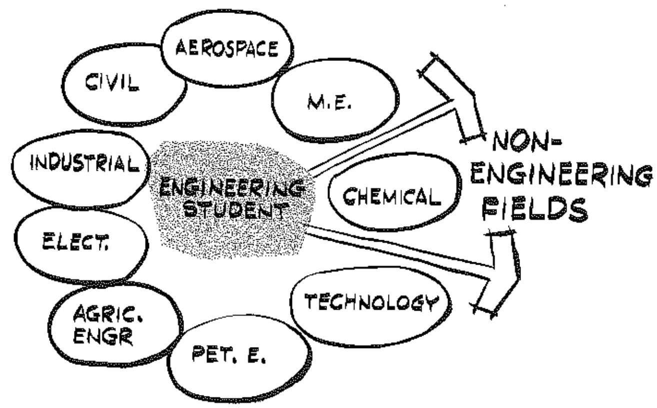


Figure 3

FUTURE

The future for graphics programs which are dedicated to the relevant objectives of the total engineering program is a bright one. A renewed strength can be obtained by adopting a positive attitude toward the role of graphics and by assuming the leadership in achieving the major objectives of the engineering curriculum through frehman graphics courses.

This is not to imply that traditional areas of engineering graphics must be rejected, but to the contrary, they are emphasized in a more relevant fashion. An area that cannot be presented in respect to a practical application should be questioned. The strength of graphics lies in the fact that most of its subject areas can be justified as an important problem solving medium.

It is my desire that the Division of Engineering Graphics turn from its defensive position and adopt a vigorous, positive posture that is necessary for a strong division.

Our future is a bright as we wish it to be provided that we pattern our course to fit the needs of engineering. We must seek a higher degree of relevance and not restrict our thinking to programs of years past. Our future begins with what we do today.

CHAIRMAN'S REPORT
to the
BOARD OF DIRECTORS
of the
DIVISION OF ENGINEERING GRAPHICS
A.S.E.E.
at
PENNSYLVANIA STATE UNIVERSITY
June, 1969

The present Engineering Graphics Division Membership Roster includes over 935 members of the American Society for Engineering Education. This number makes Engineering Graphics and Design average in size to twenty-six seperate divisional interests listed in the ASEE Data, Volume 59, Number 2, October 1968. Membership interests in Engineering Graphics and Design continues to increase gradually.

The validated election showed 479 letter ballots counted by the elections committee for officers for 1969-70. Your new officers for 1969-70 are:

Chairman
Steve M. Slaby
Princeton University

Vice-Chairman
James H. Earle
Texas A & M University

Secretary
James R. Burnett
Michigan State University

JEG Advertising Manager
Klaus Kroner
University of Massachusetts

Division Editor
Kenneth E. Botkin
Purdue University

Director & Treasurer (5 years)
A. P. McDonald
Rice University

Senior Technical Council Representative
Earl D. Black
General Motors Institute

A very successful Mid-Year meeting was held at Louisiana State University, Professor William E. Street and his staff acting as hosts. The program for this conference was diversified and well attended. Numerous industrial speakers participated. They provided a closer tie with engineering education and brought the Division up to date regarding uses of new graphical procedures and equipment including numerical control assists.

The Annual Division of Engineering Graphics program of 1969 includes two special sessions and support of ASEE-ASCA-OCD Committee on two programs having to do with computer graphics and design.

The tuesday morning session, 10:00 to 11:45 A.M., on the teme "Creativity, Communication, and Teaching Techniques" is structured around a Conference-Panel discussion in an attempt to review course construction, class preparation, and actual class procedures to get student participation in the theme subject. This session is a semi follow-up on the 1967-68 summer School. Panel members are Ivan L. Hill, Illinois Institute of Technology; H. F. Rogers, The Pennsylvania State University; and James S. Blackman, University of Nebraska. The moderator for this session is Steve M. Slaby, Princeton University, Vice-Chairman of the Division.

The Wednesday morning session, 10:00 to 11:45 A.M. on the theme "Teaching Engineering Responsibilities" includes three technical papers. E. G. F. Ramberg, Newark College of Engineering (Vice-Chairman in charge of ASEE Sections East) will discuss the subject "The Engineer and His Responsibilities in Communication". D. L. Griffin, Iowa State University (Chairman of ASEE Committee on Legal Phases of Engineering) will discuss the subject "Legal

Responsibility of The Engineer". Roy P. Trowbridge, Director of General Motors Corporation Standards (Vice-President of USASI) will discuss the subject "The Engineer's Responsibility in Developing Engineering Statndards". This session will be moderated by your newly elected 1969-70 Vice-Chairman, James H. Earle of Texas A& M University.

The Engineering Graphics Division Creative Design Display, approved on a trial basis by the ASEE Directors and Executive Board, was approved for 1969 showing and the Divisional Display Committee under the chairmanship of C. C. Cooley, University of Detroit, is being ably assisted by Robert J. Foster, Pennsylvania State University, Coordinator. The display is described on page 9 of the ASEE Advance Program. It is housed in White Hall and will be open on Monday through Wednesday during the regular exhibit hours. Awards will again be made for excellence in each of several categories, thanks to the generosity of Alfred Kreidler of Zurich, Switzerland.

The committee, first instituted under the title "Certified Design Consultants" has been renamed "Committee on Engineering Design Education". This committee, under the chairmanship of Percy H. Hill, Tufts University, has written a new set of objectives as well as rules of operation. New membership on this committee is to be initiated by a letter from a fellow teacher to the chairman of the committee, by officers of the Division, or by current members of the committee. The nomination and second will then be presented to the Executive Committee of the Division for approval.

The 1968-69 budget for the Division of $643.00, submitted to the ASEE Executive Board by Eugene G. Paré, Washington State University, was approved. Indications are that the Division will operate successfully within this budget. The request for the 1969-70 budget is $686.00. The later amount must be approved by the ASEE Executive Board.

The "Frank Oppenheimer Award", given for excellence in presentation at the Mid-Year meeting, was awarded to two speakers on the program -- James H. Earle, Texas A& M University, and F. L. LaRue, University of Southwestern Louisiana (joint award). We are sincerely grateful to Frank Oppenheimer, President of Gramercy, for his continuous efforts on behalf od the Division.

Your Chairman has been assigned a research and development project study in the "Analysis of Current Practices and Trends in Use of New Drafting and Design Equipment and Materials (including Numerical Control for plotting and machining)" and visits to Numerical Service departments in GM Corporation thus far indicate that Engineering Graphics and Design courses are here to stay a while longer. The cry by industry in this area is specifically in the areas of Descriptive Geometry, Logic, and a little Programming --- all mathematically oriented. Changes? Yes, to fill future needs and technological development. New emphasis are obvious trends.

The survey results added to the Division election ballot regarding name change got a response of 138 votes for retaining the present name and 287 votes for changing to "Division of Engineering Graphics and Design". There were 32 other suggestions ranging from "Design Graphics" 5 votes, "Division of General Engineering" and Division of Engineering Communications" 3 votes each, four suggestions with four votes each and all other suggestions with 1 vote each.

Any changes to be made, should be made in accordance with Article IX of the latest Division Constitution and By-Laws approved June 1967.

Submitted by
Earl D. Black, chairman
June 1969

SAN LUIS OBISPO, CALIFORNIA

CALIFORNIA STATE POLY

January 1970

DISTINGUISHED SERVICE AWARD

DIVISION OF ENGINEERING GRAPHICS
OF THE
AMERICAN SOCIETY
FOR
ENGINEERING EDUCATION

RESOLVED:

THAT, WITH THE PRESENTATION OF THIS AWARD, THE ENGINEERING GRAPHICS DIVISION OF THE AMERICAN SOCIETY FOR ENGINEERING EDUCATION BY THIS TOKEN ACKNOWLEDGES THE MANY DISTINGUISHED SERVICES RENDERED BY

EDWARD M. GRISWOLD

THROUGH THE YEARS 1944-1969

THE SOCIETY EXPRESSES ITS DEEP APPRECIATION FOR THOSE SERVICES, AND THE GREAT PERSONAL PLEASURE OF THE INDIVIDUAL MEMBERS IN HAVING HIS FRIENDSHIP.

PRESENTED THIS TWENTY-FIFTH DAY OF JUNE IN THE YEAR OF OUR LORD NINETEEN HUNDRED SIXTY-NINE.

Earl D. Black
Chairman of the Division

ASEE

James H. Earle
Secretary of the Division

PRESENTATION OF THE DISTINGUISHED SERVICE AWARD

by
Howard Porsch

My pleasant duty, this evening, is to speak for Jack Jacunski, Gene Paré, the other members of the Distinguished Service Award Committee, in presenting the name of the man, and the man himself, who we think has made clearly recognizable contributions to engineering graphics in several of the following ways as given in the By-Laws of the Division;

a) Success as a teacher, both as to competence in subject matter and the ability to inspire his students to high achievement.

b) Improvement of the tools of and conditions for teaching.

c) Improvements of teaching, including development of teachers, development of testing and guidance programs, and coordination of fields of subject matter.

d) Scholarly contributions of literature, honors, etc.

e) Service to the Division as follows:
   1) by regular attendance at its meetings.
   2) by service on its committees or as an officer with a record of achievement.
   3) by contributions to its publication or summer school programs

Candidates may be proposed only by members of the Division, and we as a committee appreciate the interest of the members by the many responses received. It shows their feelings and their assessments of those who are contributing to the accomplishments of the Division.

This person will join the ranks of those stalwarts who are previous recipients of this Award, and some of them are here tonight. I think that they should be recognized. _____ _ All of them have been faithful attendees, not only before they received the award, but after, and they are to be commended for their continued devotion, interest, and help.

The twentieth man to join this fraternity of contributors is a youngster --- 1 year younger than I --- receiving the B.S. degree from the Carnegie Institute of Technology, now the Carnegie-Mellon University, in 1927. He immediately went into industry and worked as a design engineer, a research engineer, and in engineering quality control. After 5 years he taught in high school for 4 years before joining his present school as an instructor, working his way through the ranks until he received his full professorship in 1962.

In the meantime he acquired the M.S. from the University of Pennsylvania and maintained his contacts with industry, serving as a consultant to several, and has received recognition by being listed in AMERICAN MEN OF SCIENCE.

During his 25 years of service to the Division, he served on many committees and almost in every office, notably as Circulation Manager and Treasurer of the JOURNAL OF ENGINEERING GRAPHICS, Secretary, and as Chairman in 1961-1962.

I present you with the name of Edward Mansfield Griswold as the 20th redipient of the Distinguished Service Award. Now I am asking the most recent recipient of this Awars, B. Leighton Wellman, to escort Mr. and Mrs. Griswold to the speakers table.

Ed, the cerificate that I am about to present to you reads as follows;

CITATION
for the
1969 DISTINGUISHED SERVICE AWARD
of the
ENGINEERING GRAPHICS DIVISION
ASEE

To Edward M. Griswold, for outstanding devotion to the interests of his engineering students and to the Division of Engineering Graphics of the American Society for Engineering Education, the Division bestows its highest honor, the Distinguished Service Award.

Edward M. Griswold, Professor of Mechnical Engineering at the Cooper Union for the Advancement of Science and Art, graduated from the Carnegie-Mellon University and later received the Master of Science degree from the University of Pennsylvania. Having served industry in his early professional career he joined the Mechanical Engineering Staff of The Cooper Union, but has continued to maintain his contacts with industry, presently serving as a consultant to several companies.

During his twenty-five years of service to the Division, he has performed faithfully and outstandingly in virtually every office od the Division, notably as Circulation Manager and Treasurer of the JOURNAL OF ENGINEERING GRAPHICS for three years, 1956-58, Secretary, 1959-60, and Chairman of the Division, 1961-62. His interests in the Division have continued since then by serving on committees of the Division.

The recognitions of his accomplishements as a teacher of Graphics are shown by the responsibilty placed upon him at his school for the freshman Graphics courses and for his Directorship of three summer institutes for High Ability Secondary School Students under the National Science Foundation. Through his teaching and his leadership he has shared his talents with his many students and colleagues.

For his attainments as a scholar and a teacher, the Division is honored to bestow upon Edward M. Griswold its 1969 Distinguished Service Award.

RESPONSE TO THE PRESENTATION
of
THE DISTINGUISHED SERVICE AWARD
by
Edward M. Griswold

Howard, Mr. Chairman, distinguished guests, members of the Division, and friends. Thank you for the honor bestowed upon me this evening. It is a singular honor because one must be nominated by fellow members of the Division to receive it. I appreciate very much that you believe that I deserve this honor. Whatever I have done for the Division has been done because I believed in the aims and objectives of the Division and wanted to help to further these objectives. It has been a pleasure to work with the people of this Division. You are all wonderful people, ladies and gentlemen, in the full sense of the meaning of the two words. Work, under these conditions is not labor, but a joy and a pleasure.

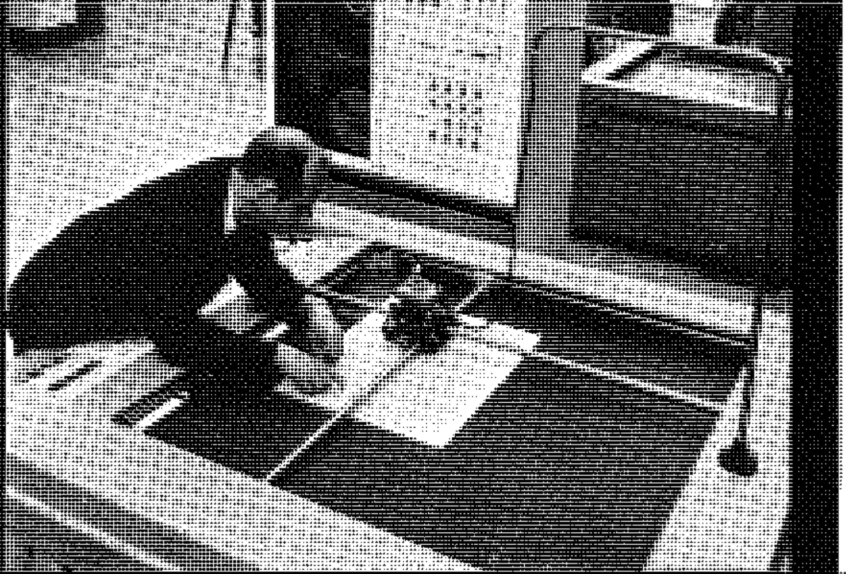
I said, a moment ago, that I believed (past tense) in the aims and objectives of this Division. I still believe in the aims and objectives of the Division, present tense. I would like to take this opportunity to urge you to continue to advocate the need for all kinds of graphics and to continue to work in this field.

We are all aware that design is one of the prime functions of engineering. An idea in the head of its inventor is worthless until it has been communicated to others and converted into usable hardware. The graphic language is one of the best means of communication. I believe that the Chinese are still right about pictures.

The computer is with us to stay and it is a marvelous tool. One can get the best program if time is taken to lay out in graphical form, the steps to be performed. It is now possible to talk to the computer in graphical language and the computer will soon be an essential tool for the designer. But we must remember that the computer will do nothing that it is not told, specifically, to do. So, if meaningful drawings are to be the output of the computer, standards must be a part of the input. Present standards may change, but new and better standards will be needed.

Research should not be neglected in our field of knowledge. Not too long ago I had a problem on a consulting job where I found it necessary to use experimental methods. I soon discovered that I had one independent variable -- time -- and five dependent variables all related to one another. To study the relationships of these variables I needed a six dimensional space. Mr. Lindgren has introduced us to N-dimensional Descriptive Geometry. Unfortunately I was unable to put it to use in this case. Nevertheless there are possibilities in his kind of research which has great potential. The need to visualize the relationships between many variables is going to be increasingly common as the systems we work with become more complex. The answer lies in research in the field of engineering graphics to be able to visualize these complex problems.

Thank you, once again, for this honor which you have seen fit to bestow upon me. I hope it does not mean that I have been completely put out to pasture. I believe that there are exciting times ahead for us.



basic

for design, analysis, communications and the computer, Second Edition, 1968
by Warren J. Luzadder, Purdue University

The **1968 Edition of Basic Graphics for Design Analysis, Communications and the Computer** is designed to fulfill today's needs of engineering and technical education. Emphasizing freehand drafting and pictorial sketching, the sketch presents the fundamentals essential to graphical solutions and communications.

These important changes have been made in the 1968 Edition—

- Chapter 10, Basic Descriptive Geometry—completely reorganized and expanded.
- Chapter 13, Introduction to Design, Sketching and Creative Thinking—expanded to give coverage to creative design.
- Chapter 14, Shop Processes, Numerically Controlled Machine Tools, and Shop Terms—includes numerically controlled machines for the first time.
- A new section of three chapters covers automated drafting and computer-aided design:

—Chapter 18, The Computer, carefully discusses what the computer is and how it operates. It prepares the student for computer application to graphics in Chapter 19.

—Chapter 19, Computer-aided Design and Automated Drafting; and Chapter 20, Photodraft Systems; explore the process of using the computer to help the engineer and draftsman with engineering design.

- The preface of the graphics text gives an excellent rationale for the computer coverage in the text.
- The new edition also includes approximately 1040 illustrations including many fully-shaded pictorial drawings illustrating space relationships.

Teaching Aids

Each chapter ends with a set of problems. These problems are designed to develop the student's ability to visualize space relationships, exercise creative ability, solve prob-

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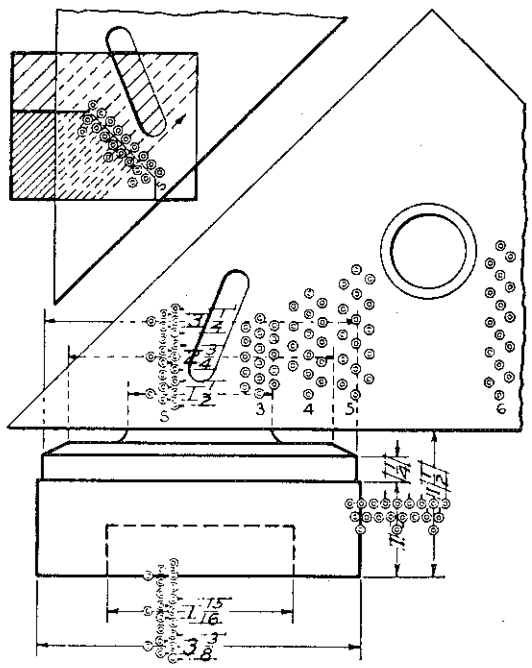

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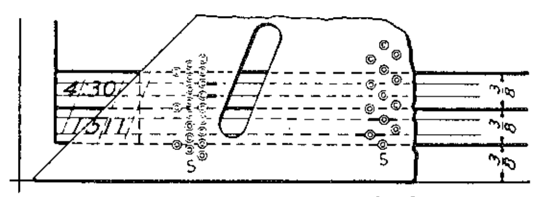

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C. C. Cooley

DISPLAYS COMMITTEE REPORT
1968-1969 Academic Year

INFORMATIONAL

This report deals with the second year of such committee activity. The previous year, under the guidance of Professor John R. Barylski, culminated in a Design Display at UCLA in June of 1968.

SPECIFIC

First work within the boundaries of this academic year was the contacting of all members of the Displays Committee, asking for their suggestions. There was also considerable correspondence with Professor Robert J. Foster of Pennsylvania State University, who agreed to act as co-chairman of the activity.

Your chairman also contacted our good friend of the Engineering Graphics Division, Mr Frank Oppenheimer of Gramercy Guild, relative to financial aid, to be applied, mainly, to prize monies for winning entries. Through his excellent efforts, we obtained, again, the sum of $1000 from Mr. Alfred Kreidler. Parenthetically, a warm human interest story attaches to this, accenting the regard that those outside the educational effort, per se, have for graphics and design in engineering education.

In October and November of 1968, some three hundred flyers were mailed to schools around the country. These elicited further inquiries, and allowed us to develop a mailing list for later mailing of entry blanks.

Concurrently, Professor Foster went ahead with the first planning of the display itself. Among other things, his group developed a prototype display module which served as a model for the later floor plan layout of the total display.

Correspondence during the winter resulted in the development of a suitable entry blank form. In April of this current year, these forms were mailed to all who had requested them. Nearly three hundred were sent to about three dozen schools.

Purposely, this report is being written after the event itself. While success, like beauty, is in the eyes of the beholder, general reaction to the event seemed to be good. Twenty four schools took part with 158 projects being entered.

Generous praise should go, without measure, to Professor Robert Foster and his co-workers at Pennsylvania State University. The summation of all the earlier planning depended largely on their efforts on the scene. They are to be commended with fervor!

Your chairman also wishes to thank the secretary at the University of Detroit, Miss Jane Burke, who handled so much of the early details and related typing as well as record keeping. The Engineering Graphics Division owes her a debt of gratitude.

Thanks go, also, to all committee members who contributed to the effort. It is hoped that a platform has been erected which will serve as a base for larger, better, and more effective displays in years to come.

Respectfully submitted
C. C. Cooley, chairman

Displays Committee

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Roland A. Byers
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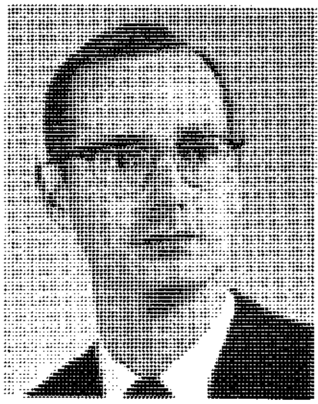


Robert J. Foster

AN OPEN LETTER
to the
DIVISION OF ENGINEERING GRAPHICS, ASEE

328 Hammond Building
University Park, Penna, 16802
July 2, 1969

Dear Colleagues;

We, here in Engineering Graphics at Pennsylvania State University, want to thank you for entering your students' creative work in design during the June meeting of ASEE. Twenty-four schools participated with a total of 158 projects.

The judges, under the supervision of John Barylski of Southeastern Massachusetts University, had a long, hard job of picking the award winners. They finally awarded eleven prizes to entries from Arizona State University, Worcester Polytechnic Institute, Wisconsin University - Milwaukee, Louisiana State University, Northeastern University - Suburban Campus, and Texas A & M University.

If you were among the winners -- Congratulations! If you were among the majority of us non-winners, rest assured that the attendees of the display found your projects worth studying. We received numerous favorable comments on the quality of nearly all student work that was presented.

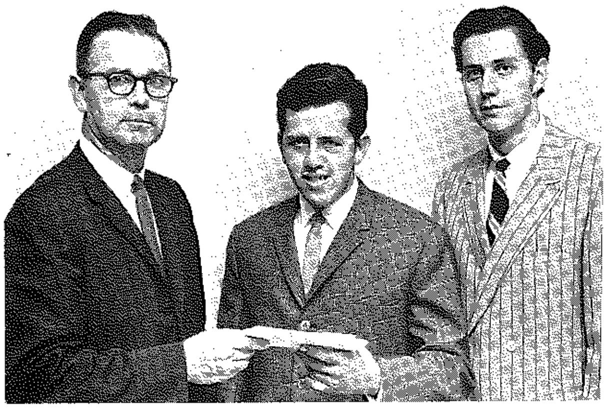
Sincerely,
Robert J. Foster

AWARD WINNERS
INTRODUCTORY CREATIVE DESIGN
DISPLAY
Pennsylvania State University
June 1969

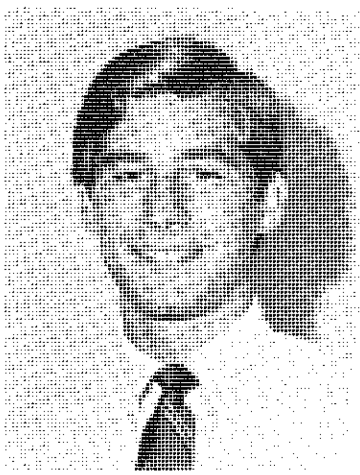
SOPHOMORE PROJECTS

First Prize - team
SNAKE CONVEYER
Designers: Ernesto V. Solera
Santiago Torrijos
Instructor: Prof. Clarence E. Hall
School: Louisiana State University

First Prize - individual
PHOTOCELL AUTOMATIC SHUT-OFF DEVICE and AUTOMATIC BURNER CONTROL
Designer: John Christian Kuhta
Instructor: Prof. A. S. Levens
School: University of California at Los Angeles



Ernesto V. Solero and Santiago Torrijos shown with their instructor Dr. Clarence E. Hall.



John C. Kuhta

Professor A. S. Levens

FRESHMAN PROJECTS

Individual

First Prize

FREEZER PLUG EXTRACTOR

Designer: Steven P. Richter
Instructor: Prof. E. W. Knoblock
School: University of Wisconsin - - Milwaukee

Second Prize

CONSTANT CURRENT POWER SUPPLY

Designer: James Lucy
Instructor: Prof. Carlton W. Staples
School: Worcester Polytechnic Institute

Third Prize

AUTOMOBILE LUGGAGE STORAGE DEVICE

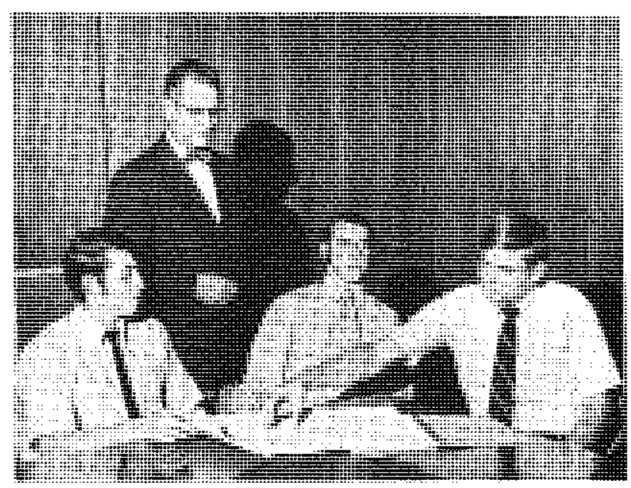
Designer: Richard T. Shankle
Instructor: Prof. Samuel M. Cleland
School: Texas A & M University

Team

First Prize

AUTOMATIC POWER HAMMER

Designers: Jerry Ransdell
John Anderson
Michael Drum
Terry Hastings
Harry Haver
Instructor: Professor Eugene Cooper
School: Arizona State University



Seated from left to right are Jerry Ransdell (chief engineer), Harry Haver and Michael Drum. Substituting for Professor Eugene Cooper, in the picture, is Dr. George C. Beakley

AUTOMATIC ROTARY ANTENNA

Designers: Charles E. Martin
Gregory C. Massoud
Lance K. Ellsworth
Instructor: Prof. John H. Whenman
School: Worcester Polytechnic Institute

Professor John H. Whenman reviewing students' design with Charles E. Martin and Lance K. Ellsworth. Missing from picture is Gregory C. Massoud.

Second Prize

EDUCATIONAL TOY - LOGIC GAME

Designers: Elizabeth E. Ames
Steven Slesinger
Instructor: Prof. Borah L. Kreimer
School: Northeastern University - - Suburban Campus

FIRE DETECTION DEVICE

Designers: Robert S. Hubler
Clarence Haskell, Jr.
Ernest LaMertha III
Gary Stephenson
Instructor: Prof. Eugene Cooper
School: Texas A & M University

Third Prize

AUTOMOBILE CONTROL

Designers: Gregory O. Wilbanks
Billy Terry Luce
Richard T. Shankle
John F. Griffin III
Jerry W. Hoermann
Harry R. Neinast, Jr.
Instructor: Prof. Samuel M. Cleland
School: Texas A & M University

Runner-Up (First)

A FOOT OPERATED CAR JACK

Designers: Steven J, Stair
Donald P. Preau
Instructor: Prof. John A. Brewer III
School: Louisiana State University

Runner-Up (Second)

MAGAZINE SYSTEM FOR A MOVIE PROJECTOR

Designers: William Kossowan
William Ryan
Frederick Piecewicz
Instructor: Prof. Borah L. Kreimer
School: Northeastern University - - Suburban Campus

Runner-Up (Third)

PROPOSAL FOR A STUDY DESK

Designers: AL Lichtenburg
Bill Gilmore
Grant Young
Darrel Weatherly
Instructor: Prof. Larry D. Goss

HONORABLE MENTIONS (Freshman Team)

CAN OPENER THAT FORMS A SPOUT
School: University of Illinois at Chicago Circle

IMPROVED TRAFFIC LIGHT
School: Arizona State University

AUTO REGULATED INTRA-VENOUS FEEDER
School: Arizona State University

A THEFT PROOF CASH DRAWER DEVICE
School: Arizona State University

WAVE PWERED GENERATOR
School: Virginia Polytechnic Institute

OUTLET SAFETY
School: Western New England College

TRAILER FACILITY
School: Texas A & M University

AN ECONOMICAL CEMENT MIXER
School: Texas A & M University

MODIFICATION OF A SERVICE STATION
School: Texas A & M University

HOME EXERCISER
School: Texas A & M University

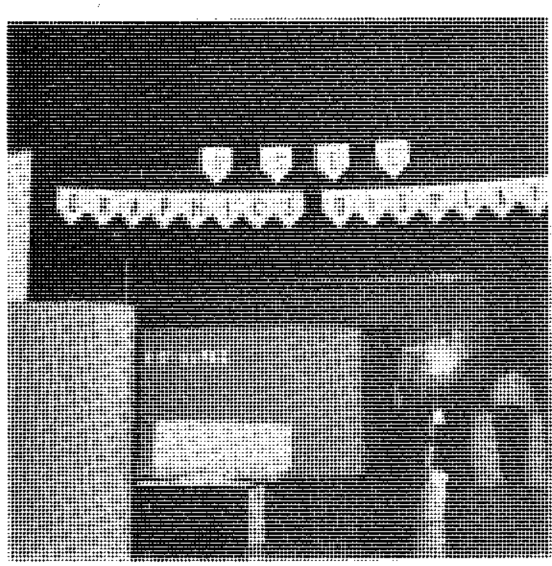
HOUSING FOR MARRIED STUDENTS AT TEXAS A & M UNIVERSITY
School: Texas A & M University

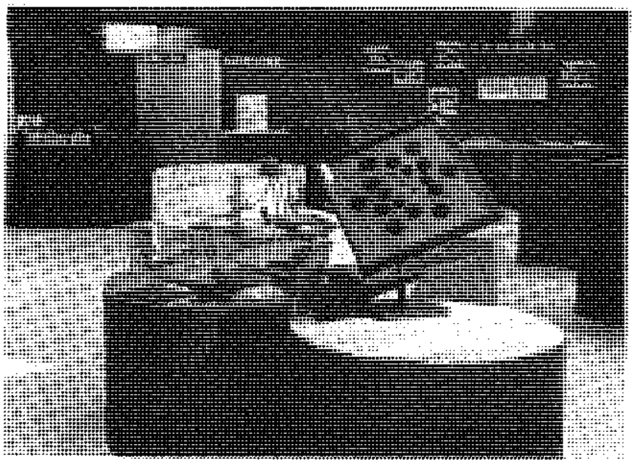
HOME EXERCISER
School: Texas A&M University

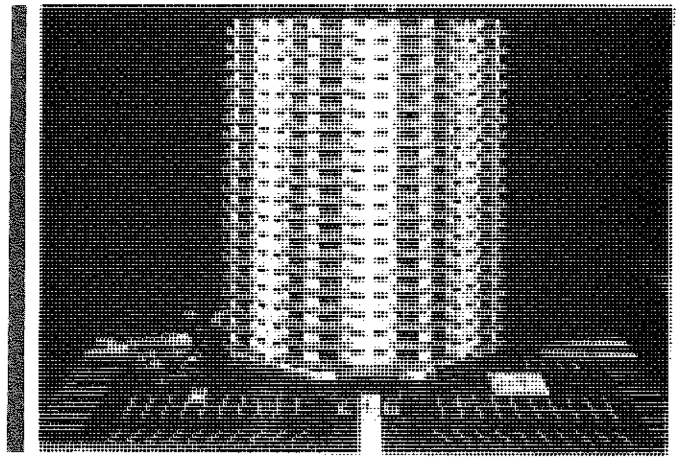
BETTER VALVE DEVELOPMENT
School: University of Nebraska

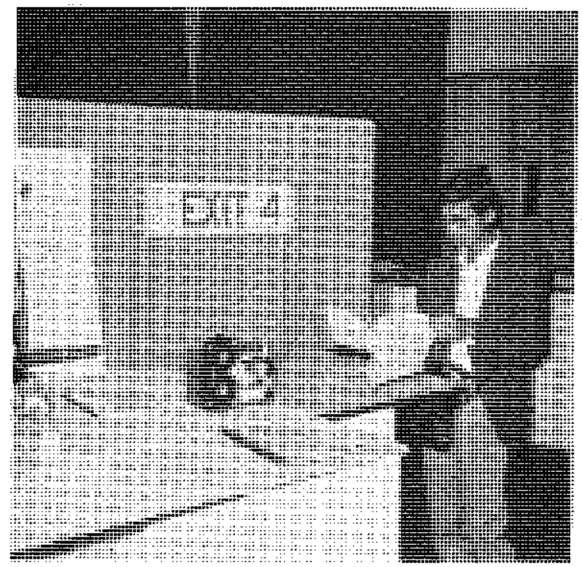
HONORABLE MENTION (Freshman Individual)

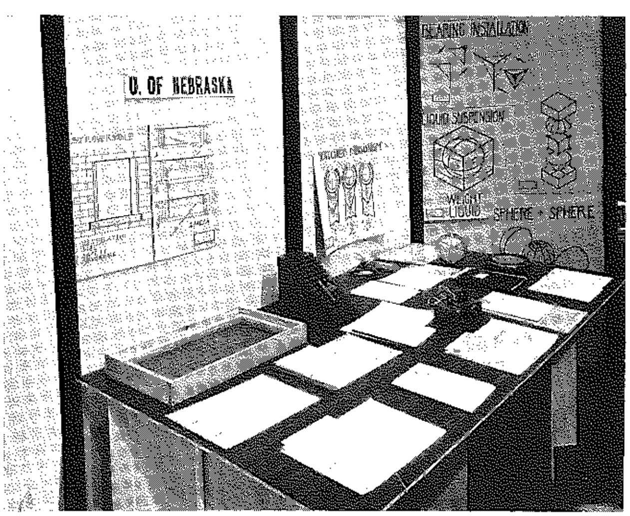
AUTOMOBILE LUGGAGE STORAGE DEVICE
School: Texas A & M University

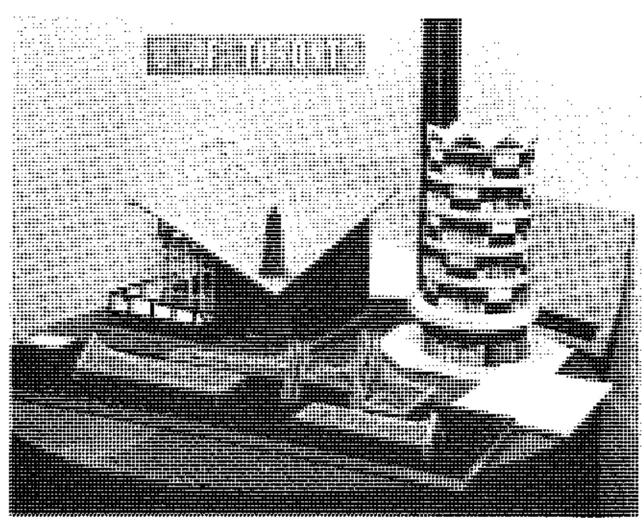








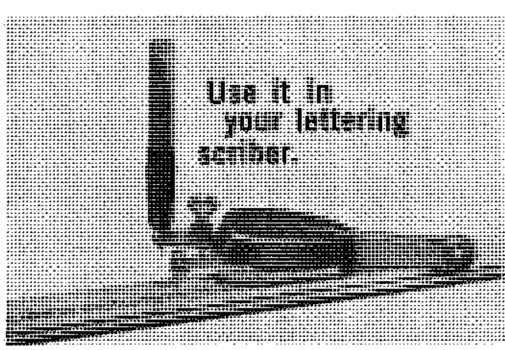

U. OF NEBRASKA
BEARING INSTALLATION
LIQUID SUSPENSION
WEIGHT
LIQUID
SPHERE + SPHERE

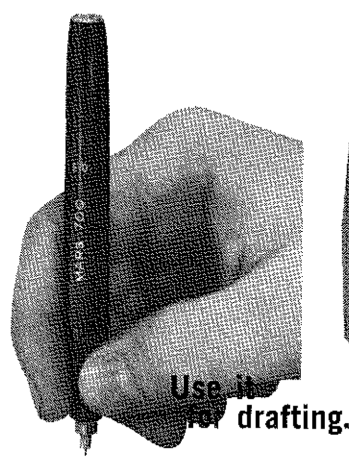


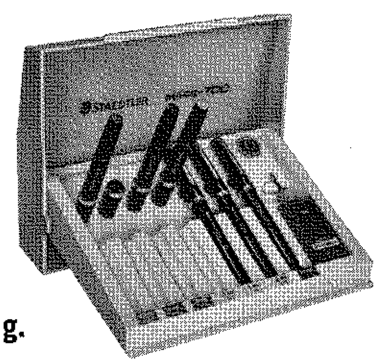
The New UF 0000 Point. Another First from Mars.

UF (Ultra-Fine) MARS Technical Pen Points — the finest size ever made — produce incredibly thin lines. Now offered in 12 distinct line width sizes, MARS "Dual-Purpose" Points can be used in all technical pens—including those designed for lettering scribers. Available from dealers everywhere.

The MARS Dual-Purpose Pen doubles up to do the work of two pens.







MARS 700
TECHNICAL PENS

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In Canada: J. S. Staedtler-Canada, Ltd, Toronto

MID - YEAR MEETING

engineering graphics division - asee

SAN LUIS OBISPO, CALIFORNIA

CAL STATE POLY

January 21-24, 1970

WELCOME TO CAL POLY

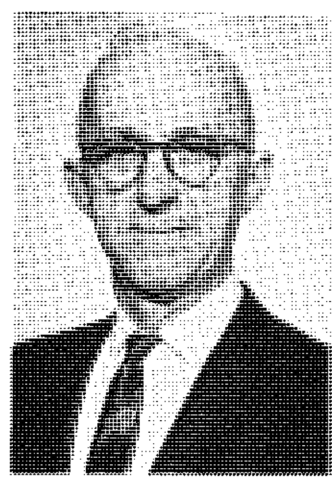
A hearty welcome to the Division of Engineering Graphics, American Society for Engineering Education from the friendliest campus of California.

Extending best wishes to each of you attending the Cal Poly meeting will be Dr. Robert E. Kennedy, President of California State Polytechnic College; Dr. Archie Higdon, Dean of the School of Engineering and Technology and R. Wallace "Wally" Reynolds. Wally is being assisted by four colleagues in the Engineering Technology Department: Theodore G. Graves, Earl R. Hesch, Robert M. Johnston, Richard T. Kombrink, and by Ramond G. Gordon of the Mechanical Engineering Department.

Located midway between Los Angeles and San Francisco, Cal Poly has undergone a period of rapid growth in recent years. With over 11,000 students the college occupies a 374 acre academic core, utilizing much of the 5,169 acre campus for practical instruction in agricultural programs ranging from egg production to range management. Nearly 2,000 members of the student body are engaged in ten engineering majors, conducted in modern laboratories.

The following pages are designed to inform you concerning Cal Poly's programs, the San Luis Obispo area, and plans for your visit.

Dr. ROBERT E. KENNEDY, President
California State Polytechnic College



Dr. ARCHIE HIGDON, Dean
School of Engineering & Technology

THE CAL POLY STORY

Cal Poly is one of nineteen colleges comprising the California State College System, which is the largest system of public higher education in the western hemisphere and one of the largest in the world. In addition to the programs in the School of Engineering and Technology, Cal Poly offers degree programs in Schools of Agriculture, Applied Sciences, and Architecture, and prepares graduates for elementary and secondary school teaching.

Historically, Cal Poly's method of education and dedication to occupational-centered curricula has created for the College a distinctive role in higher education in California. The College is particularly noted for its emphasis on agriculture, business, engineering, and home economics, together with the closely-related supporting fields of natural sciences, physical sciences, and mathematics.

In each program in the College, the student begins work in the major field of his choice during the freshman year. A concurrent sequence of general education and elective courses assists the student in relating this chosen area of study to other fields of knowledge. Practical educational experiences in the major field prepare the student for specific occupations and professions or advanced study. Student and faculty participation in the development and improvement of both curricular and co-curricular programs characterizes the College's mode of operation.

California State Polytechnic College began with the establishment in 1901 by the State Legislature of a vocational high school at San Luis Obispo. The institution served as a forerunner in vocational education for agriculture and industry in California. In 1921 its Board of Trustees was dissolved and the State Board of Education administered the school until July 1, 1961 when administration passed to the Trustees of the California State Colleges.

Cal Poly began offering junior college courses in 1927, and became a two- and three year institution in 1933. In 1936 a degree transfer program was added, and in 1940 the first bachelor of science degrees were authorized.

The first baccalaureate exercises were held in 1942. Approval to grant the master of arts degree in education was received in 1949, and to grant the master of science degree in 1967. The master of business administration degree has been approved for 1969-1970. The college's academic master plan for 1970-75 includes proposed degrees in several areas of agriculture and sciences, a master's program in architectural engineering, a master's of engineering degree, and programs in tranportation engineering, measurement science, engineering science, and construction science, including master's degree in the latter.

THE SCHOOL OF ENGINEERING and TECHNOLOGY

The school of Engineering and Technology at Cal Poly is one of the largest such educational units in the Western United States. With a facukty of over one hundred, it enrolled 2,379 students this fall.

Engineering has a strong tradition at Cal Poly, dating back to the school's founding in 1901

First courses in the area of engineering were offered under the heading of "Mechanics" as early as the first decade of the century. Departments and divisions of "mechanics" and later of "engineering/mechanics" were organized about 1920 and continued through the two- and three year college phases of Cal Poly's development.

"Industrial education" was the unifying name used for the college's engineering program during the early 1940's, followed late in the decade by "Engineering and Industrial Division."

The title "Engineering Division" came into use in the 1950's and continued until early 1967, when all of Cal Poly's major instructioal unit were designated as "schools."

Cal Poly, which received authorization to begin offering bachelor's degree programs in 1940, has provided college-level degree study in engineering for more than 5,000 young men and women since that time.

When degree programs began, only major aurricula in aeronautical industries, electrical industries, mechanical industries, and air conditioning industries were offered, but as they developed the term "engineering" replaced the "industries" reference.

This fall, Dr. Robert E. Kennedy, Cal Poly President, announced that the college's School of Engineering would be named School of Engineering and Technology. The change had been unanimously recommended by the school's department heads and Dean Higdon.

President Kennedy pointed to the change as an indication of the future direction of engineering and technical education at Cal Poly.

"Any industry representatives or others who thought Cal Poly was going to become theory-oriented in its engineering programs ought to be reassured that it is our intention of expanding our spectrum of service," he added.

Departments in the school include: Aeronautical Engineering, Electrical Engieering, Electronic Engineering, Engineering Technology, Environmental Engineering, Industrial Engineering, Industrial Technology, Mechanical Engineering, and Weldind and Metallurgical Engineering.

Accreditation of the college's degree curricula in Aeronautical, Electrical, Electronic, Industrial, and Mechanical Engineering by the Engineers' Council for Professional Development was announced this fall.

Graphics courses for all engineering curricula, including Agricultural Engineering which is administered by the School of Agriculture, are presented by the newly-formed Department of Engineering Technology.

JAMES M. McGRATH, Head
Engineering Tachnology Department

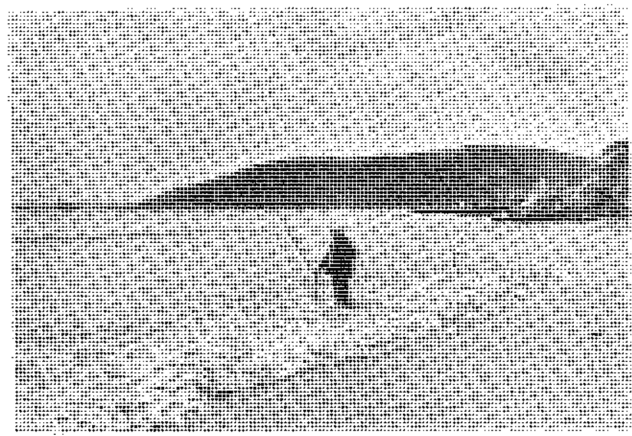
SAN LUIS OBISPO
and
CALIFORNIA'S CENTRAL COAST

Not only id San Luis Obispo the home of Cal Poly, but it is also the hub of one of the most interesting and delightful vacation areas in the West.

Newspaper tycoon William Randolph Hearst, with resources enabling him to live anywhere in the world, created at nearby San Simeon a one-hundred-room castle which is now a state historical monument, revealing its treasures and vistas to millions of visitors.

In downtown San Luis Obispo itself the fifth Spanish mission in Alta California, Mission San Luis Obispo De Tolosa, was established in 1772 by Father Junipero Serra. Still an operating church and school, the mission contains an excellent museum of Indian and early Californian artifacts. The all-year climate attracts many visitors to San Luis Obispo. Convenient are golf, swimming, sailing, surfing, and fishing.

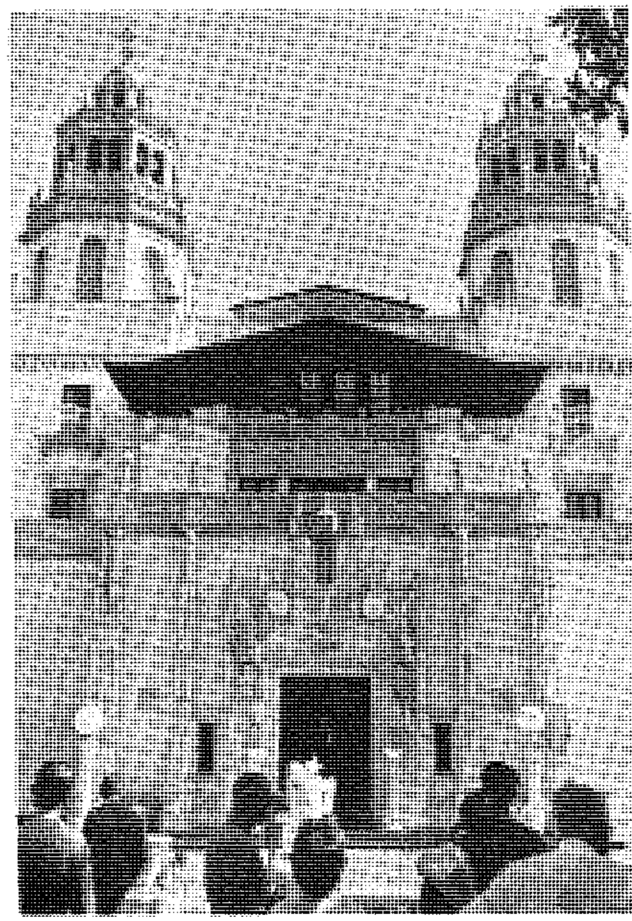
The hosting committee has planned visits to the Madonna Inn, a unique luxury motel with individually styled rooms of hard carved wood, quarry stone, and leaded glass; the picturesque sheltered harbor of Morro Bay, and to the interesting shops of San Luis Obispo's Mission Mall, as well as to the Hearst Castle.

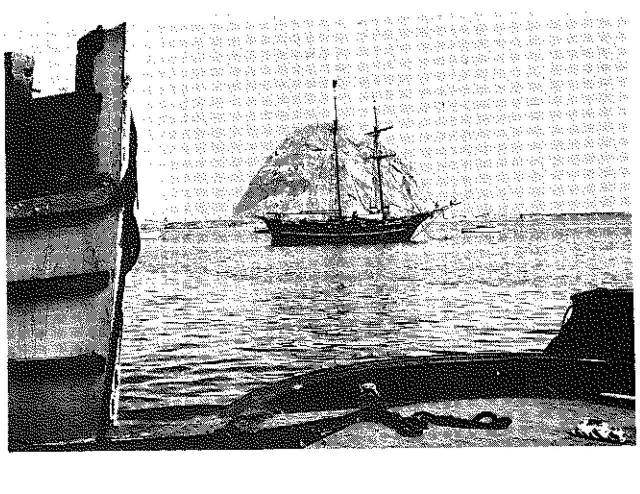


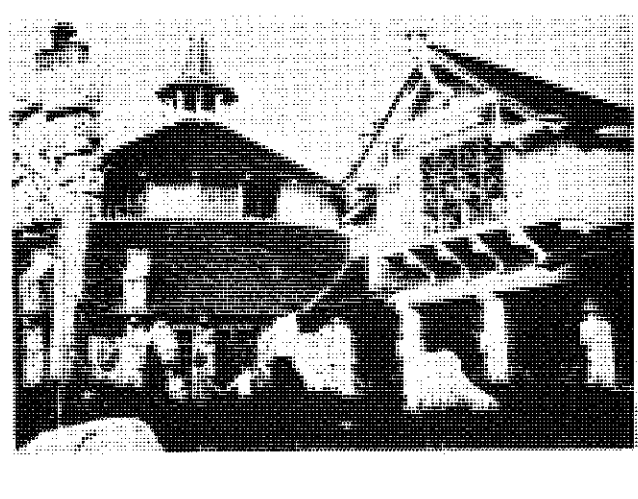
Optional trips to the castle and to the west coast missile base at Vandenberg Air Force Base will be available for those who arrive early on Wednesday.

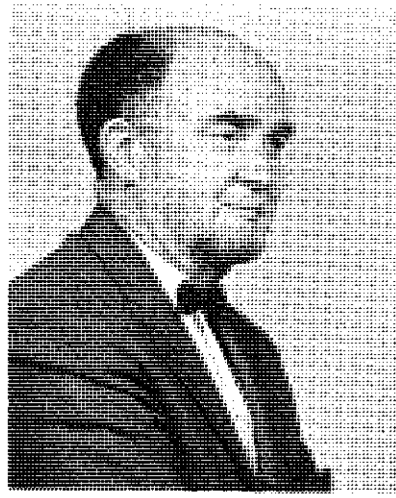
San Luis Obispo, a city of 30, 000, is within a few minutes drive of the resort towns of Cambria, Morro Bay, Shell Beach, and the famed Pismo Beach where visitors can conveniently drive along eighteen miles of white sand beach, for deep sea fishing on charter boats from Morro Bay.

If this sounds like the description of an area where you might wish to live and retire, you're right - your hosting committee is particularly interested in introducing Eastern visitors to the pleasures of life in the West.









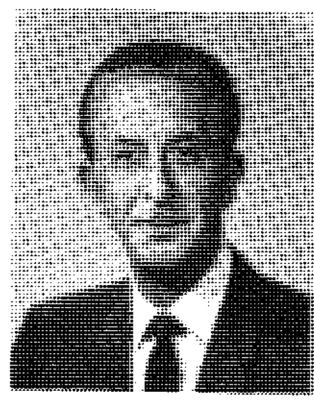
R. WALLACE REYNOLDS
General Chairman

The program for the 1969-70 Mid-Year meeting might be accused of "jumping the gun" on the A.S.E.E. Annual meeting for 1970 at Ohio State in June, which has adopted "The Computer" as the general theme for the meeting.

Computerized graphics systems provide one of the two main themes for the program at Cal Poly in January of 1970. The program is balanced with presentations on new approaches to instruction in graphics, some up-to-date reports on Design type courses and creativity in graphics instruction and, perhaps for the first time at a Mid-Year meeting, several topics directed particularly to the interest of Community College teachers.

The computerized graphics theme is headlined by the Friday morning panel of industry experts led by Mr. Tram Pritchard of the Lockheed Missile and Space Systems Division, who is familiar to many Graphics Division members who read his "Looking Around" column in GRAPHIC SCIENCE. Mr. Protchard has wide experience and much contact with his subject, both in his position as director of the computerized graphics systems in use at Lockheed, and in his capacity as West Coast Editor of GRAPHIC SCIENCE. He is in a position to speak with authority on the relationship between this "state of the art" in industry and the implications it holds for engineering and technical education.

Important new approaches to self-teaching of graphics courses will be revealed in the presentations by Professor Larry Goss of Oklahoma State University, Professor Klaus Kroner of the University of Massachusetts, and Professor Knoblock and his panel of colleagues from Wisconsin.

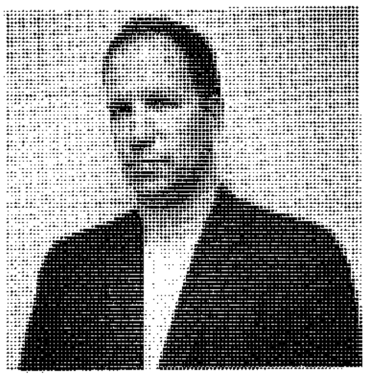


Mr. Tram Pritchard

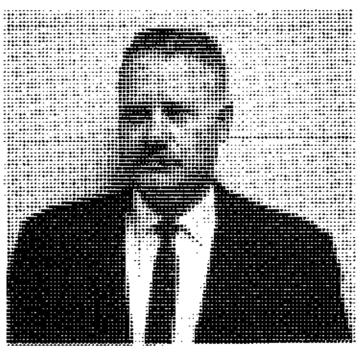
Prof. Klaus Kroner

Goss and Kroner will present two approaches to self-teaching in graphics subjects, utilizing computers and other elctrical and mechanical devices for communication. If these presentations are sufficiently effective, you may be able to stay and enjoy the golfing, fishing, etc., at San Luis Obispo and trust your students to take care of their own education.

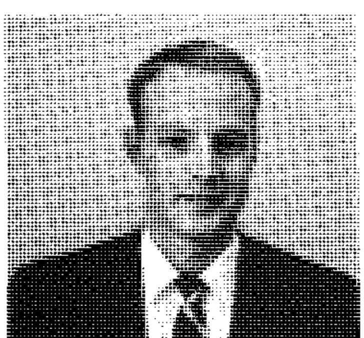
Professors Knoblock, Ratledge, and Kusmider will present an important new approach to the planning and development of curricula and course content of systems design. The presentations will be based on the authors' experience in applying these methods within the entire University of Wisconsin system and community colleges in that geographical area.



Prof. Edward W. Knoblock

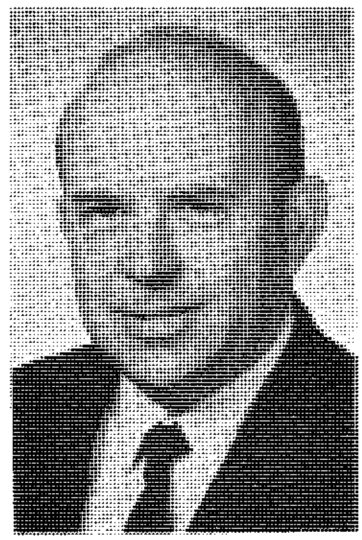


Prof. E. T. Rutledge



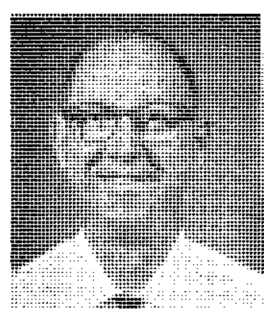
Prof. S. J. Kusmider

Three of the program items will be of particular interest to community college faculty. These will be highlighted by Professor William Husing's report on Friday afternoon. This report is the result of a one year, in-depth study encompassing 35 engineering organizations and 81 community colleges in California funded by the Office of Education, HEW. The primary purpose was to determine the exact functions and effects of current automated grafting devices and systems on drafting and technical personnel and the recommendations of these persons regarding traing and education in the graphics courses. This will be the first presentation of this important sur vey to an educational group (copies of the complete 125 page report will be available to the attendees of the Mid-Year meeting. Professor Husing is coordinator of all training in engineering drafting at Citrus College in the eastern Los Angeles suburban area.



Prof. William T. Husung, Jr.

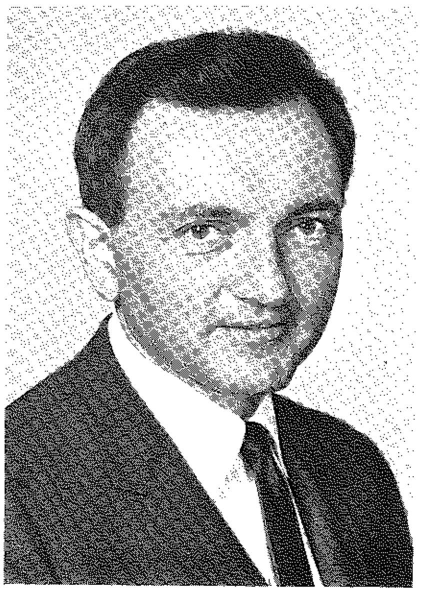
The panel on Advisory Committees for Engineering Drafting Programs in Community Colleges will be led by Mr. Herbert Gernandt, a design supervisor at Jet Propulsion Labora-



Mr. Herbert Gernandt

tory in Pasadena and a long-time member of the Industrial Relations Committee of the Division of Engineering Graphics. This report, as well as those of Professors Husing and Knoblock, should furnish valuable information to both the community college and degree college faculty.

Design course, which have loomed very large in recent Graphics Division meetings are not entirely forgotten. Professor Percy Hill and Dean Jim Blackman will give us new projections of creativity, and another insight into this many-faceted talent will be revealed by our banquet speaker, Mr Jack Ryan, Chief Designer for Mattell Industries.



Mr. Jack Ryan

The presentations by Mrs Quinn, Engineering Librarian at the IBM Corporation in San Jose, Marc Sauvageau from Ecole Polytechnique de Monteal, and an audience discussion on the 'state of the art' in Design Project type graphics courses led by Professor James Earle of Texas A & M University should add some variety to the principal topics.

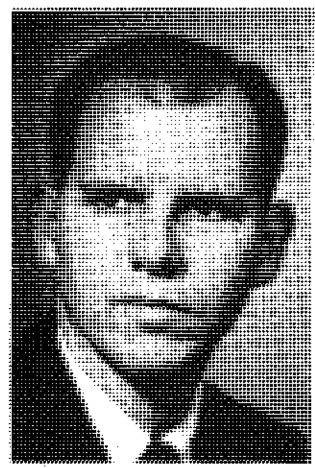
In the overall picture, the program of tours for the ladies has been chosen from the many nationally famous recreational and sightseeing facilities available in this center of year-round recreation on the California coast. Golfing, deep-sea fishing, surfing (wetsuits are needed in January for those over 30) are available within twenty minutes of the campus of Cal Poly.

Optional tours to Hearst Castle and the West Coast Missile Center at Vandenburg Air Force Base aill be provided for attendees who

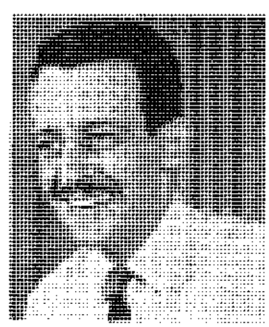
Prof. Percy Hill

Dean James Blackman

would like to arrive a day early to take in one of these and still miss none of the technical sessions.



Prof. James Earle



Prof. Marc Sauvageau

Wednesday, January 21, 1970

12:00 Noon to 9:00 P.M.
Early Registration

1:30 P.M. to 6:00 P.M.
Pre-Convention Tours
(Dependent on early registration)
HEARST CASTLE
or
VANDENBURG AIR FORCE BASE

Thursday, January 22, 1970

8:00 A.M. to 6:00 P.M.
Registration
Little Theatre

9:00 A.M. to 10:40 A.M.
General Meeting
WELCOME TO CAL POLY
Dr. Archie Higdon
Dean, College of Engineering and Technology

COMPUTERIZED FILING SYSTEMS FOR PUBLICATIONS IN ENGINEERING GRAPHICS
Karen Takle Quinn
IBM Corporation; San Jose, Calif.

TEACHING AN ENGINEERING SIXTH SENSE THROUGH DESIGN PROJECTS
Professor Percy H. Hill
Tufts University

10;40 A.M. to 11:00 A.M.
Coffee Break

11;00 A.M. to 12:45 P.M.
General Meeting
CREATIVITY - ITS CARE AND CULTIVATION AMONG ENGINEERING STUDENTS
Dean James Blackman
University of Nebraska

A NEW SYSTEM FOR EXACT AXONOMETRIC PROJECTION FROM MULTIVIEW PROJECTION
Professor Marc Sauvageau
Ecole Polytechnique de Montreal

1:00 P.M. to 2:00 P.M.
Luncheon & Announcements

2:15 P.M. to 3:30 P.M.
General Meeting
APPLICATIONS OF HYBRID COMPUTER SYSTEMS TO ENGINEERING GRAPHICS
Professor James Burnett
Michigan State University
and
Forrest Woodworth
University of Detroit

3:30 P.M. to 3:45 P.M.
Coffe Break

3:45 P.M. to 4:45 P.M.
General Meeting
TOWARD AN AUTOMATED GRAPHICS CLASSROM
Professor Larry Goss
Oklahoma State University at Stillwater

4:45P.M. to 6:00 P.M.
Meetings of Standing Committees

6:30 P.M.
Executive Committe Dinner Meeting

Friday, January 23, 1970

8:00 A.M. to 5:00 A.M.
Late Registration
Little Theatre

8:30 A.M. to 10:30 A.M.
General Meeting
CURRENT DEVELOPMENT AND OPERATIONAL USE OF COMPUTERIZED GRAPHICS SYSTEMS IN ENGINEERING AND THE IMPACT ON ENGINEERING AND TECHNICAL EDUCATION
Mr. Tram Pritchard
Lockheed Missile and Space Systems Division, and Associate Editor, GRAPHICS SCIENCE

Selected Panel of Industry Experts

10:30 A.M. to 10:50 A.M.
Coffee Break

10:50 A.M. to 12:45 A.M.
General Meeting
COMPUTER MEDIATED INSTRUCTION PROGRAMS IN ENGINEERING GRAPHICS
Professor Klaus Kroner
University of Massachusetts

ADVISORY COMMITTEE FOR ENGINEERING DRAFTING PROGRAMS IN COMMUNITY COLLEGES

Panel

Mr. Herbert Gernandt
Jet Propulsion Laboratory

Mr. Leon
Fluor Corporation

Professor Nimmo
Mt. San Antonio Junior College

1:00 P.M. to 2:30 P.M.
Luncheon and Business Meeting

2:35 P.M. to 4:00 P.M.
General Meeting

REPORT ON THE EFFECTS OF AUTOMATION ON THE NATURE OF DRAFTING WORK, AND INNOVATIVE PROGRAMS OF INSTUCTION FOR AUTOMATED DRAFTING IN JUNIOR COLLEGES IN CALIFORNIA

Professor William Husing
Citrus College

Forum

STATE OF THE ART IN DESIGN TYPE GRAPHICS COURSES

Moderator

Professor James H. Earle
Texas A & M University

4:00 P.M. to 5:45 P.M.
Guided tours of Manufacturing Processes Laboratories, Welding Laboratories, Engineering Graphics Laboratories, and Creative Design Classes (Senior Year). Classes will be in progress in these laboratories.

7:00 P.M. to
Banquet

Speaker: Mr. Jack Ryan
Chief Engineer
Mattell Industries
(Topic to be announced)

Saturday, January 24, 1970

8:00 A. M. to 10:00 A.M.
Late Registration

8:30 A.M. to 11:00 A.M.
General Meeting

SYSTEMS APPROACH TO COURSE DEVELOPMENT FOR ENGINEERING GRAPHICS -- RATIONALE, APPLICATION AND IMPLICATIONS

Professor E. W. Knoblock
University of Wisconsin, Milwaukee

Professor E. T. Ratledge
University of Wisconsin, Milwaukee

Professor S. J. Kusmider
Oakland Community College

11:00 A.M. to 11:15 A.M.
Coffee Break

11:15 A.M. to 12:00 Noon
General Meeting

2002 A.D. ------- AND ENGINEERING GRAPHICS

(Speaker to be announced)

12:00 Noon
Announcements and Adjournment

WOMEN'S PROGRAM

Thursday, January 22, 1970

9:30 A.M.
Assemble and Coffee

Bus Tour
MORRO BAY, CAYUCOS, CAMBRIA

12:00 Noon
Luncheon at San Simeon

1:30 P.M. to 4:30 P.M.
Tour
HEARST CASTLE STATE HISTORICAL MONUMENT

Friday, January 23, 1970

9:30 A.M.
Assemble and Coffee

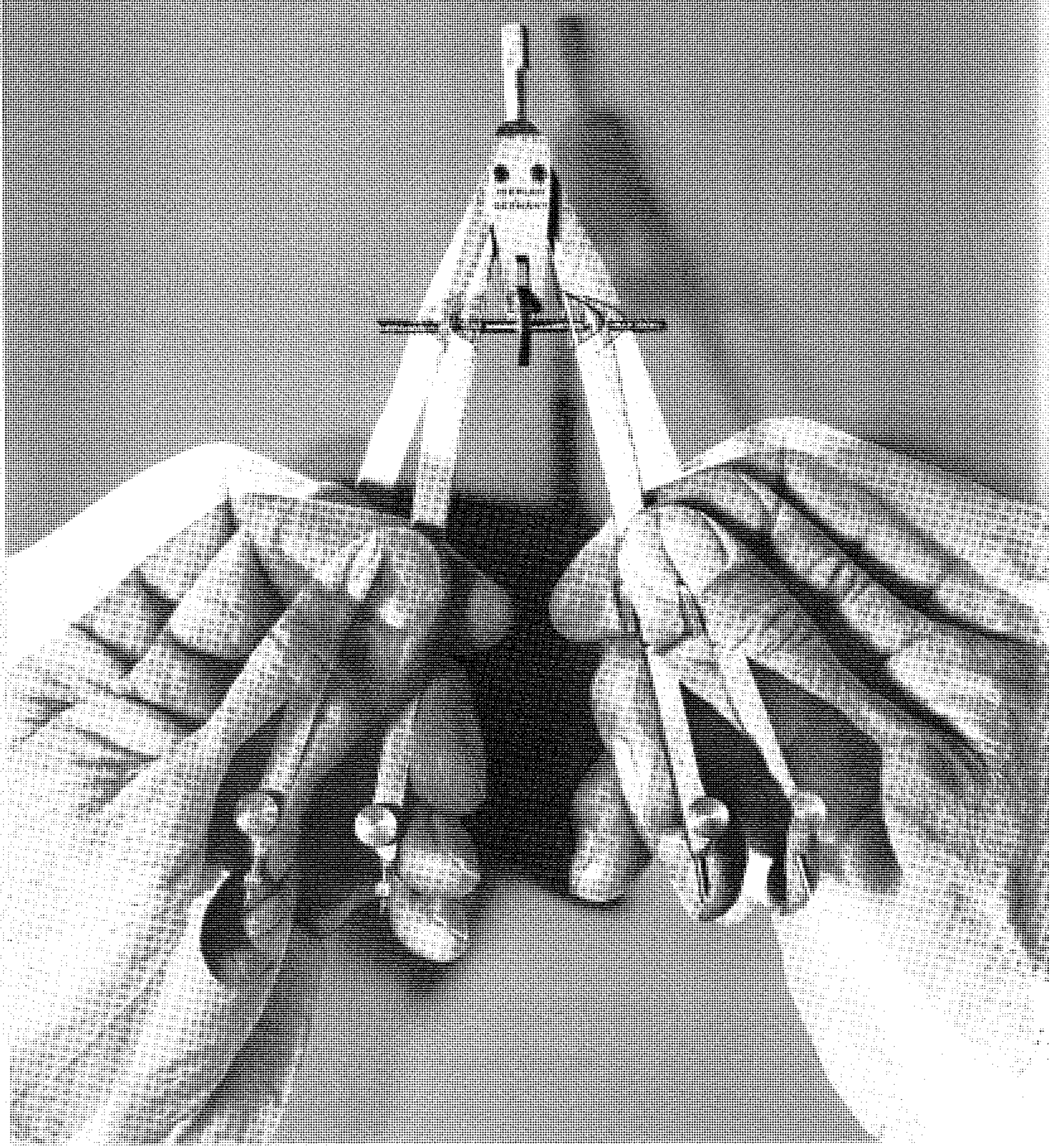
10:00 A.M.
Tour
HISTORICAL SAN LUIS OBISPO MISSION, ART CENTER

12:00 Noon to 2:00 P.M.
Luncheon and Tour
MADONNA INN

2:30 P.M. to 4:00 P.M.
Tour
MISSION MALL SHOPS, COURTYARD

RIEFLER

Miracle Bow



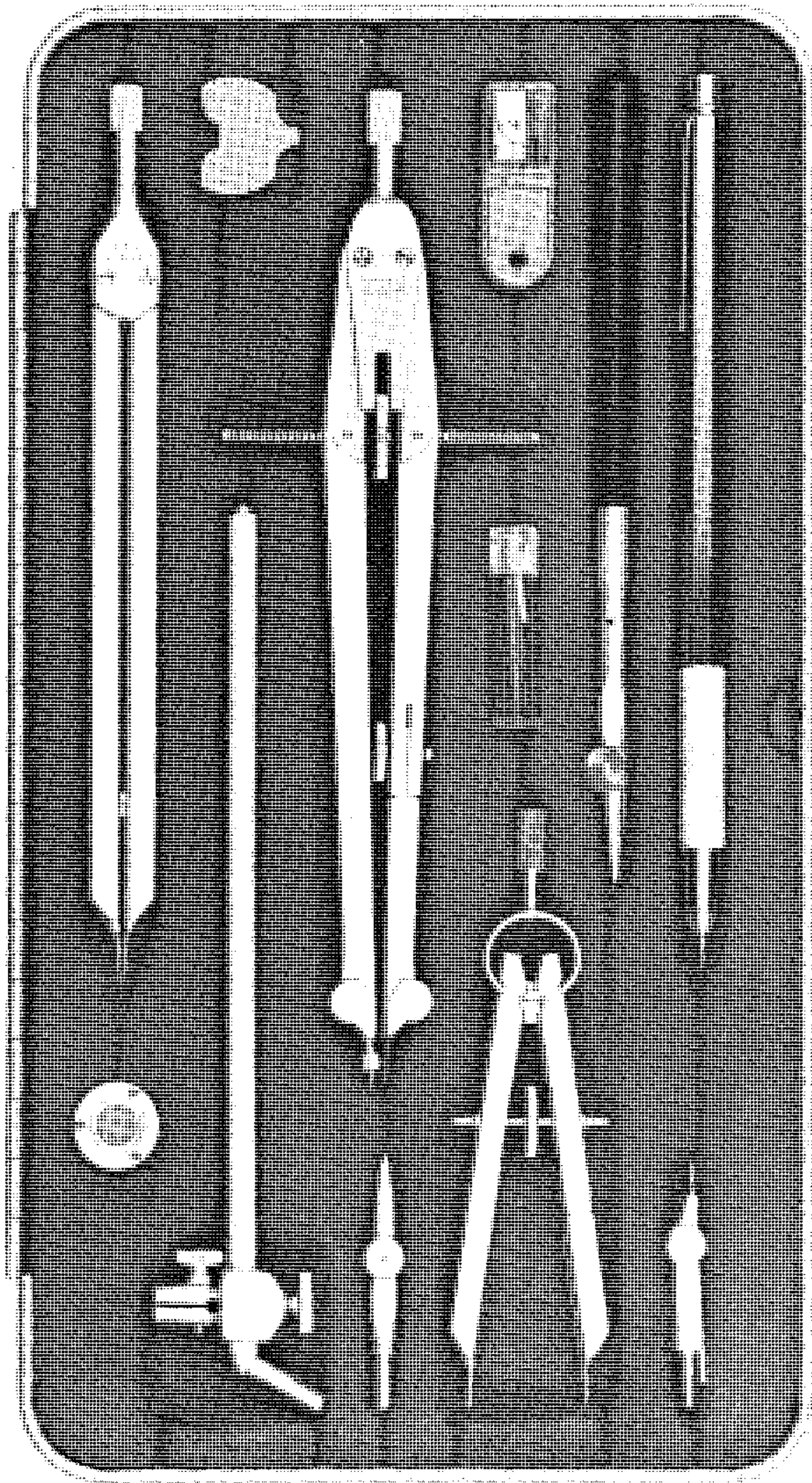
Available Instruments and Set Combinations

R400	6½" Miracle Bow fixed pencil
R64	6½" Miracle Bow with pen and pencil attachments and slip handle threaded needle point
R64A	Same with lengthening bar
R108	6" divider
R113	4½" bow divider (not shown)
R114	4½" bow pen (not shown)
R115	4½" bow pencil (not shown)
R113D/A	4½" bow combination with pen, pencil and divider attachments
R118	Drop bow (not shown)

All Individual Instruments Attractively Packed in Plastic Sheath

R052	R400, R108 in plastic sheath or hard plastic case
R052P	Same with mechanical pencil MC82
R055	R400, R108, R115 in wood case
R64	In hard plastic case
R64P	Same with mechanical pencil MC82
R1	R64, R108 slip handle in wood case
R1A	R64A, R108 slip handle in hard plastic case
R8AP	R64A, R108, R113D/A slip handle in metal case or wood case
R8AP Gramo	Same plus Gramo-inker holder, 2 extra nibs, 2 mechanical pencils MC82 in hard plastic case

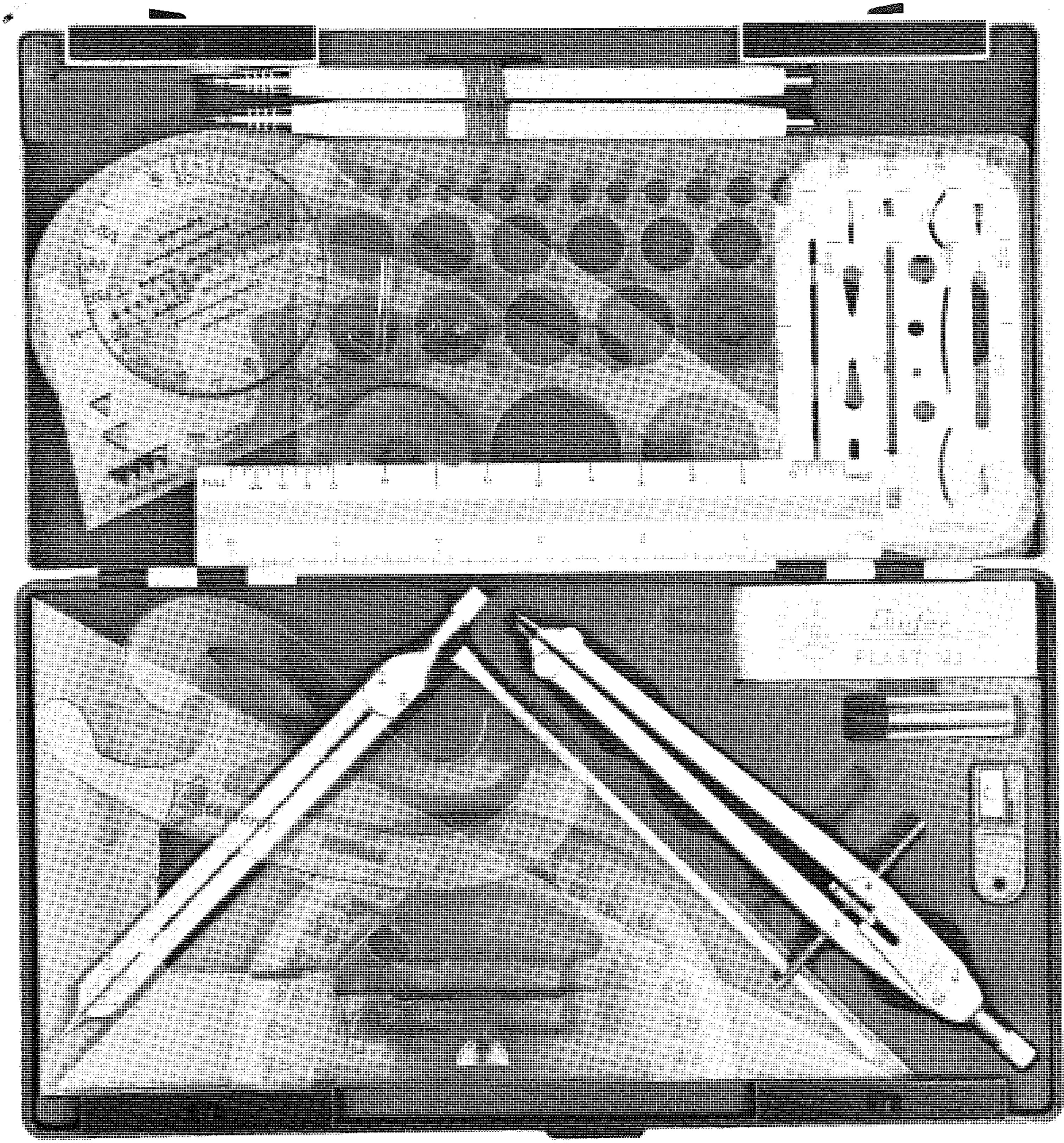
All sets come with lead and needle boxes, screwdriver, and polishing cloth
Instruments are heavily chromium plated
Available in satin finish or highly polished



R8AP in metal case or wood case
Instruments heavily chromium plated
Satin Finish or Highly Polished

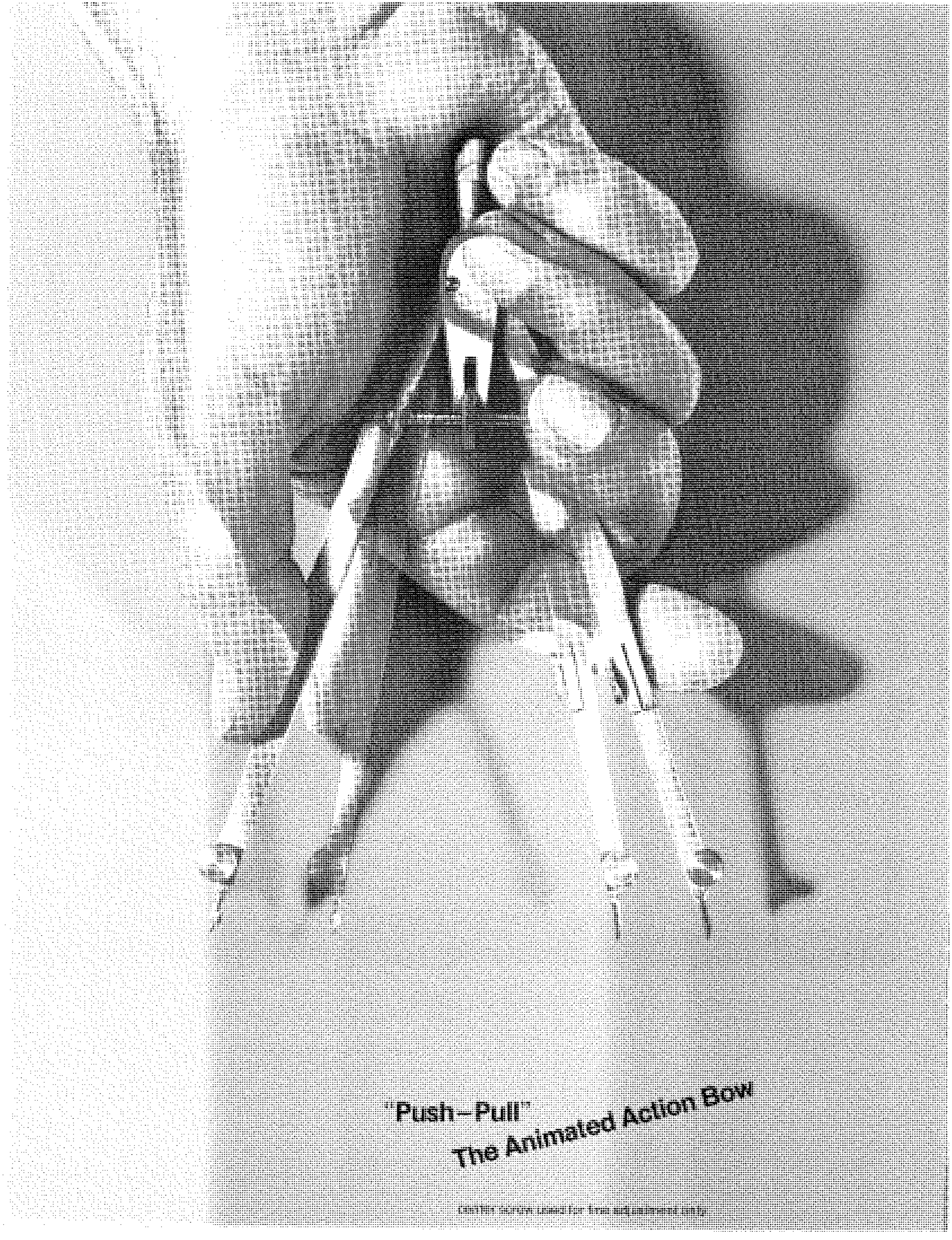
RIEFLER **Gramercy**

Miracle Bow Series



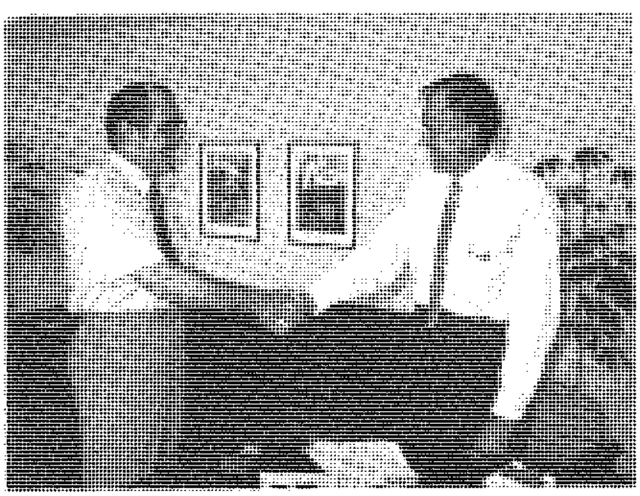
R441 The Compact Drafting Kit
Content:
R400, R108 acrylic triangles 45° 6" and 60° 8," protractor 180° 5," curves #80 and #82, metal erasing shield, 2 mechanical pencils 1 extra lead, leadpointer, circle template #1117, plastic eraser, lead and needlebox, special combination scale 6" with architects, civil, mechanical engineers divisions, engine divided—extra addition: lettering guide

Also Available:
R440—Same however R64 with pen part and slip handle instead R400 and eraser


"Push – Pull"
The Animated Action Bow

Chairman Steve Slaby of the Division of Engineering Graphics was invited to meet with the executive secretary of A.S.E.E., Mr. Leslie B. Williams, on September 11, 1969 in the nations capital, at the A.S.E.E. headquarters. The agenda included the change of name for the Division, budget, policies for Division publications, and clarification of funds which the parent organization has belonging to the Division. Although this agenda may not seem to require a very long meeting, the discussions continued from about 10:00A.M. to 3:00P.M. The only break came during the three or four minutes required to order lunch. It should now be quite obvious that much was discussed which was of great importance to our organization.

The name "Division of Engineering Graphics and Design",which was accepted by the membership, has strong opposition from the Engineering Design Committee who feel that the word "Design" is being used improperly. Professor Slaby argued that "Design" could have a different meaning to different people --- which may be a healthy situation. He also indicated that the requested name change was favorably voted upon by the membership of the Division. Although Mr. Williams does not oppose this change, he informed our chairman that the matter must be taken up by the Council of Technical Divisions and Committees of which the Engineering Graphics Division is a member. It was also suggested that an alternate name, such as "Engineering Design Graphics" be submitted in the event that the first choice is rejected.



Mr. Leslie B. Williams (left), executive secretary of ASEE with Professor Steve M. Slaby, chairman of the Division of Engineering Graphics

More than an hour was spent on discussions concerning policies for publications. Although the JOURNAL OF ENGINEERING GRAPHICS has adhered to nearly all of the policies in the past, it is now necessary to go forward.. All issues of the Division's publication must now be copyrighted and must have definite deadlines for submitting material and for publication. The Journal must also show that it is a non-profit organization and the finacial reports should show a "Zero" balance. Upon further discussion, it became apparent that should there be "excess" finances, it would be advisable to use it for the improvement of the publication. This is to insure no difficulties concerning federal tax laws. These policies allow a publication to better serve the members of its Division in the form of news, articles, etc..

The operating budget for the Division, which was submitted for the 1969-1970 school year, was then discussed. The approved budget was more than $250 less than requested. Mr. Williams indicated several reasons for the cut, including a report that less than half of the previous budget was used for the Division needs. However, the important omission was expenses for the Annual Creative Design Display. When questioned about this, the executive secretary asked to discuss the Display seperately. After considerable persuasion, chairman Slaby agreed. He also agreed that he would accept the budget cut if the Display were financed in another manner.

Continuing with the discussion of monies that belong to the division, Mr. Williams asked about $985 that appeared in the A.S.E.E. books. When an explanation was given, , r. Williams asked chairman Slaby to send him a memo indicating the purpose for which Mr. Alfred Kreidler made the donation to the Division (Steve took care of this matter less than one week later). The money may then be drawn at any time the Division needs it for the purpose for which it was donated. The figure of $985, however, seemed a bit peculiar, and the question arose concerning the expenditure of #15. Upon investigation it was found that this amount should have been charged to the operating budget for 1968-1969 and the correction was immediately made. The Division now has $1000 from which it may draw for any activity to carry out the purpose for which Mr. Kreidler has made the donation.

(continued on page 66)

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1969-1970

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Perspective

PROFESSOR FRANK M. WARNER

Frank M. Warner, 85, professor emeritus of engineering at the University of Washington, died on Sunday, August 31, 1969.

Born in Scranton, Iowa, Professor Warner reveived his B. S. degree in Mechanical Engineering at the University of Wisconsin. He joined the faculty of the University of Washington in 1913 after teaching at Washington State University and at the University of Wisconsin.

Professor Warner was active in professional, civic, and religious activities. He served as president of the Pacific Northwest Section of the American Society for Engineering Education. His textbook "Applied Descriptive Geometry" was translated for use by students in various parts of the world. He was a member of the Municipal League and the American Bible Society, a life elder at the University Presbyterian Church and a past president of the University Lions Club.

Survivors include his wife Cornelia; daughters, Mrs. J. G. Patrick of Hillsborough California and Mrs. R. L. Hamack of Edwards Washington; sister, Mrs. Olive Warner of Seattle, Washington; seven grandchildren.

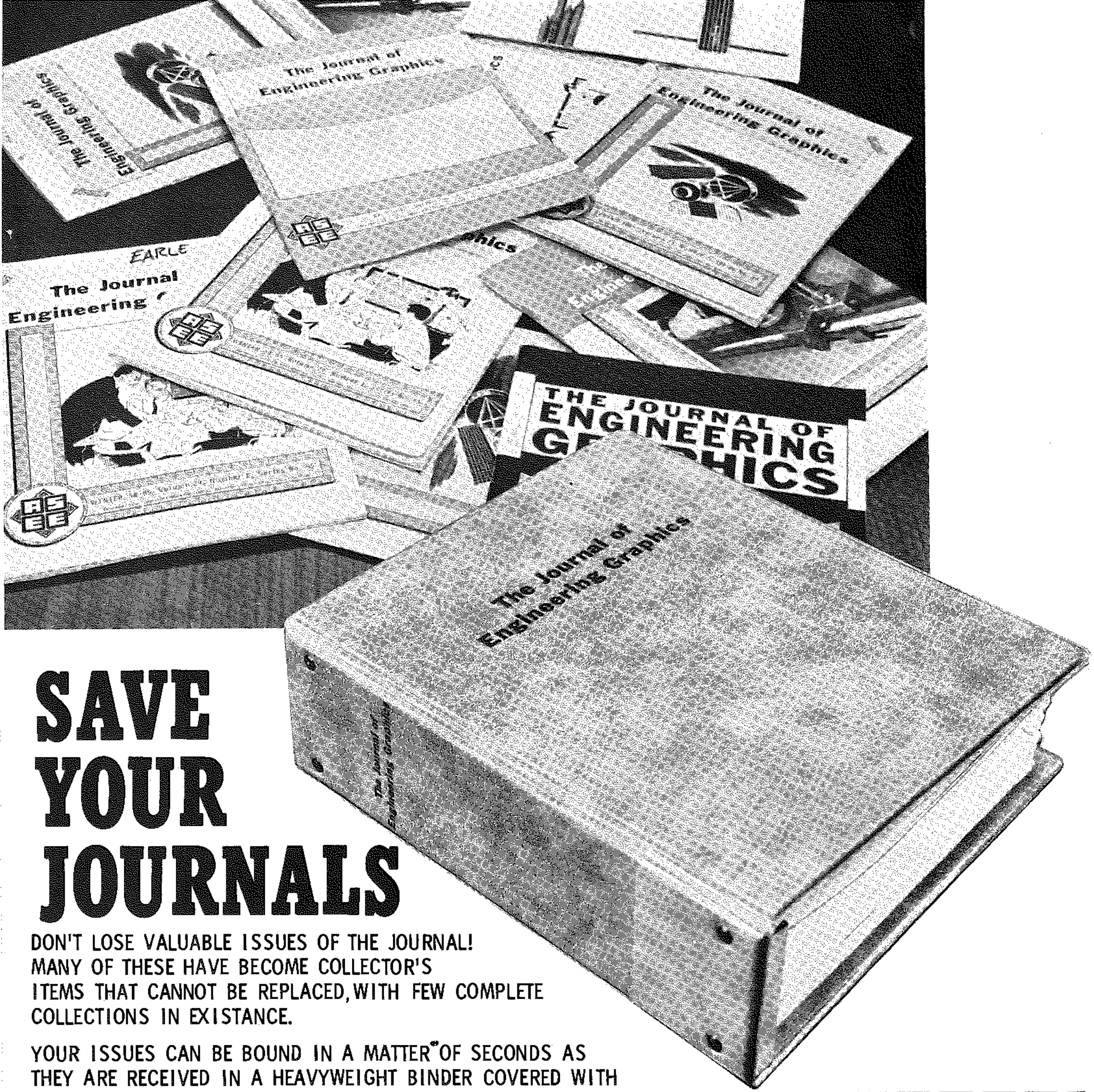
Memorial services were held on Thursday, September 4, 1969 at the University Presbyterian Church.

PROFESSOR JERRY DOBROVOLNY

The faculty of the General Engineering Department of the University of Illinois is kept quite busy with the beginning of the school year, but the chairman of the department, Jerry Dobrovolny has undertaken additional duties. Jerry has been appointed to the Illinois State Advisory Council on Vocational Education.

Although this work is interesting, as well as important, it is, nevertheless, time consuming since this group is one of the most active educational groups in the state. Knowing Professor Dobrovolny's enthusiasm we are sure that he is contributing valuable knowledge and activity to the purposes of this council.

Good Luck, Jerry!



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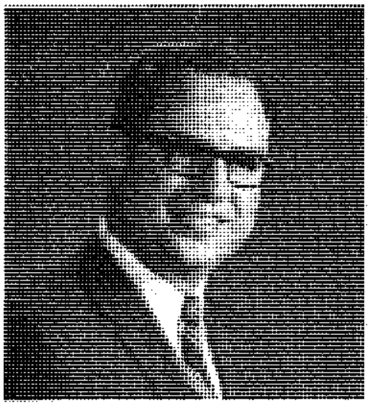


MECHANICAL DIFFERENTIATION

by

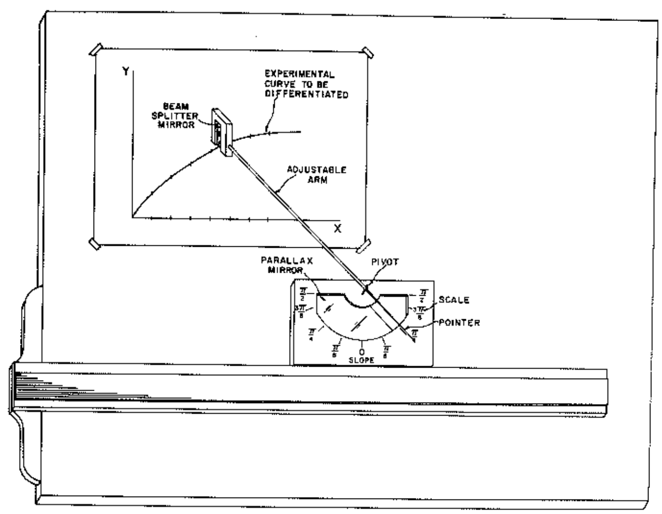
James R. Hammerle
Assistant Professor
Department of Biological and Agricultural Engineering
North Carolina State University

Often it is necessary to obtain the slope, tangent, or normal to a curve which cannot be expressed algebraically. Engineering equations contain many differential expressions, and when the curve to be differentiated is available only graphically, the equations are unuseable without some method of mechanical differentiation.

Although textbooks do mention instruments designed specifically for mechanical integration and the planimeter method accomplishing the same purpose, no reference has been made to mechanical differentiation. The simple instrument, shown in the accompanying figure, enables graphic solutions of equations containing derivitives, and can be operated with high sensitivity by untrained persons. The tangent technique of determining the slope of a curve using a ruler and protractor and straight-edge is well known. However, repeatability is very poor - several individuals asked to determine the slope of a curve at a specified point using this method, show a great variability among results. With the mechanical differentiator repeatability is consistant.

The curve to be differentiated, no matter how complicated, is mounted on a drawing board and intervals marked on the curve at equidistant points measured along the X-axis. The semi-transparent beam splitter mirror (1 mm. thick) is then positioned at a point on the curve. It is then possible to look into the beam splitter and see, not only the reflection of the curve to the left of the mirror, but to observe, at the same time, the curve to the right of the mirror. By aligning the small transparent mirror so that the reflected image of the portion of the curve on one side is superimposed directly upon the portion of the curve that is visible through the mirror, the mirror will be perfectly normal to the curve. The pointer is then observed vertically from above (assured by alignment of its reflection in the backing parallax mirror), and the slope of the tangent to the curve reads easily to 0.01 radians (or 0.5 degrees). By merely interchanging scales it is possible to read directly the normal to the curve. If the second derivitive is required, it is possible to plot dy/dx vs x and mechanically differentiate to obtain d^2y/dx^2

The ease of use, sensitivity, accuracy, and low cost of the instrument make it a useful tool with which the engineer should be familiar.



DETERMINATION of NORMAL STRESSES in UNSYMMETRICAL BENDING by GRAPHICAL METHODS

by

C. Samonov
Lecturer
School of Mechanical Engineering
The University of New South Wales
Kensington, N.S.W., Australia

The article "Graphical Determination of Normal Stresses in Unsymmetrical Bending" by C. Samonov is being republished with the permission of MACHINE DESIGN in which publication it appeared in the September 16, 1965 issue.

NOMENCLATURE

F	Force
I_n	Moment of inertia with respect to neutral axis x_nx_n
I_x	Moment of inertia with respect to axis xx
I_{xy}	Product of inertia with respect to axes xx and yy
I_{x_1}	Moment of intertia with respect to axis x_1x_1
$I_{x_1y_1}$	Product of inertia with respect to axes x_1x_1 and y_1y_1
I_y	Moment of inertia with respect to axis yy
I_{y_1}	Moment if inertia with respect to axis y_1y_1
I_η	Principal moment of inertia with respect to axis $\eta\eta$
I_ξ	Principal moment of inertia with respect to axis $\xi\xi$
$I_{\xi\eta}$	Product of inertia with respect to principal axes $\xi\xi$ and $\eta\eta$
i	Scale of the moment of inertia
l	Scale of the beam section
M	Bending moment
M_n	Projection of the bending moment vector on the neutral axis
m	Scale of the bending moment
s	Scale of the bending stress
xx	Given centroidal axis of inertia
x_1x_1	Rotated centroidal axis of inertia
x_nx_n	Neutral axis
yy	Given centroidal axis of inertia
y_1y_1	Rotated centroidal axis of inertia
α	Angle of rotation of the axis x_1x_1 with respect to axis xx
α_o	Angle between the principal axis $\xi\xi$ and the given axis xx
β	Angle between the neutral axis x_nx_n and the axis xx
δ	Angle between the plane of loading and the principal axis $\eta\eta$, or between the moment vector and the axis $\xi\xi$
$\zeta\zeta$	Axis perpendicular to the neutral axis x_nx_n
$\xi\xi$	Prinipal axis of inertia
ψ	Slope of the stress distribution diagram with respect to axis

σ Bending stress

ϕ Angle between the plane of loading and the axis yy, or between the moment vector and the axis xx

ψ Angle between the plane of loading and the axis , or between the moment vector and the axis $x_n x_n$

1. INTRODUCTION

Unsymmetrical bending occurs when plane of loading does not contain one of the PRINCIPAL axes of inertia $\xi\xi$ or $\eta\eta$ of the cross-sectional area, Figure 1. The stress calculations could be further complicated if the known moments of inertia I_x and I_y are with respect to the non-principal centroidal axes xx and yy, Figure 2. The numerically greatest bending bending stress will occur at a point on the periphery of the cross-section with the maximum distance ζ from the neutral axis $x_n x_n$, Figure 3. Therefore, to locate the point with the maximum stress, the location of the neutral axis $x_n x_n$ must first be determined. A graphical solution, based on Land's circle of inertia, which locates the neutral axis $x_n x_n$ of the beam section, and also gived the stress distribution with respect to the neutral axis, is very simple and less time consumimg as compared with the, admittedly more accurate, numerical method. The construction of Land's circle of inertia and its application for location of the principal axes of inertia and graphical determination of the second moments of an area are explained in the following sections.

2. MOMENTS OF INERTIA AND PRODUCT OF INERTIA WITH RESPECT TO ROTATED CENTROIDAL AXES

Values must be given for the moments of inertia I_x and I_y and the product of the inertia I_{xy} with respect to two centroidal mutually perpendicular axes xx and yy, Figure 4. Mark off from the point "O" as origin of the given reference axes xx and yy in the direction of yy axis the length OK representing in a certain scale the value of I_x, and adjoining the length KD representing I_{yy}. Divide the line OD in half, point "C", and draw a circle with OD as diameter and with the center at point "C". This circle is called Land's Circle of Inertia. From the point "K" draw a line KT parallel to the xx axis, and make $KT = I_{xy}$, to the right of OD if positive, to the left if negative. The point "T" is termed the Pole of Inertia.

If the axes xx and yy are rotated to a new position x_1x_1 and y_1y_1, given by the angle α between the axes ox and ox_1, they will intersect the circle of inertia in points A_{x1} and B_{y1}. A line TK_1 drawn through the pole of inertia "T" perpendicular to the diameter $A_{x1}B_{y1}$ will intersect it in a point "K_1". The, the moments of inertia I_{x1} and I_{y1} and the product of inertia I_{x1y1} with respect to the axes x_1x_1 and y_1y_1 are given by the following lengths:

$$(1) \quad \left.\begin{aligned} I_{x_1} &= A_{x_1}K_1 \\ I_{y1} &= B_{y_1}K_1 \\ I_{x_1y_1} &= TK_1 \end{aligned}\right\}$$

<u>Proof:</u>

From the construction shown in Figure 4:

$$OC = \frac{OD}{2} = \frac{I_x + I_y}{2}$$

and

$$CK = OK - OC = I_x - \frac{I_x + I_y}{2} = \frac{I_x - I_y}{2}$$

Through point "K" draw a line EH perpendicular to $A_{x_1}B_{y_1}$. and through point "T" a line TE parallel to $A_{x_1}B_{y_1}$. Then:

$$\angle xox_1 = \alpha = \angle DOB_{y_1} = \angle A_{x_1}B_{y_1}O$$

and:

$$A_{x_1}CO = 2\alpha = \angle DCB_{y_1} = \angle EKT$$

Considering the geometry of construction, we obtain:

$$A_{x_1}K_1 = A_{x_1}C + CH - HK_1$$

but:

$$A_{x1}C = OC = \frac{I_x + I_y}{2}$$

$$CH = CK\cos 2\alpha = \frac{I_x + I_y}{2}\cos 2\alpha$$

and:

$$HK_1 = ET = KT\sin 2\alpha = I_{xy}\sin 2\alpha$$

thus:

$$A_{x_1}K_1 = \frac{I_x + I_y}{2} + \frac{I_x - I_y}{2}\cos 2\alpha - I_{xy}\sin 2\alpha = I_{x_1}$$

now:

$$I_x + I_y = I_{x_1} + I_{y_1} = A_{x_1}B_{y_1} = \text{constant}$$

therefore:

$$B_{y_1}K_1 = B_{y_1}A_{x_1} - A_{x_1}K_1 = I_{x_1} + I_{y_1} - I_{x_1} = I_{y_1}$$

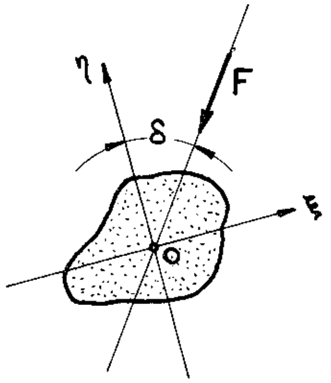


Figure 1.

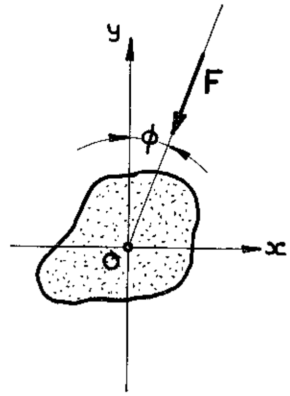


Figure 2.

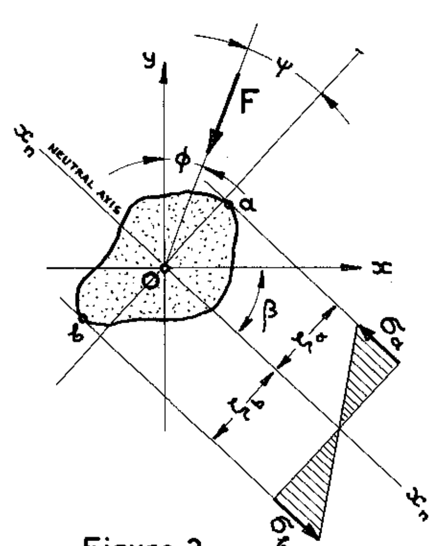


Figure 3.

Further, from Figure 4:

$$TK_1 = EH = EK + KH$$

but:

$$KH = KC \sin 2\alpha = \frac{I_x - I_y}{2} \sin 2\alpha$$

and:

$$EK = TK \cos 2\alpha = I_{xy} \cos 2\alpha$$

thus:

$$TK_1 = \frac{I_x - I_y}{2} \sin 2\alpha + I_{xy} \cos 2\alpha = I_{x_1 y_1}$$

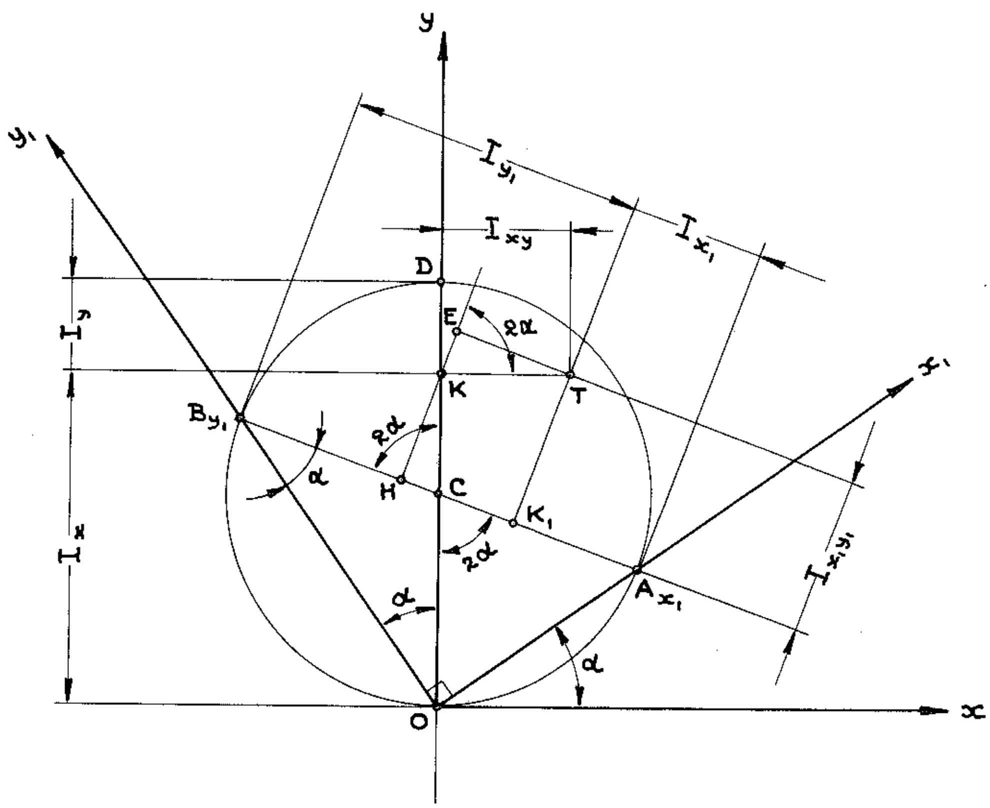


Figure 4.

3 LOCATION OF PRINCIPAL AXES OF INERTIA

For the principal axes of inertia $\xi\xi$ and $\eta\eta$, the product of inertia $I_{\xi\eta}$ must be zero, and the principal moments if inertia I_ξ and I_η have maximum and minimum values.

It is obvious from the Figure 5 that, if a line is drawn through the pole of inertia "T" and the centre "C", the length TK will be zero. The line CT intersects the circle of inertia in points A_ξ and B_η, and consequently, the lines OA and OB drawn through centroid "O" and points "A_ξ" and "B_η" are the principal axes of inertia. Hence,

$$TK_1 = I_{\xi\eta} = 0$$

$$TA_\xi = I_\xi \quad \text{(Minimum value in our case)}$$

$$TB_\eta = I_\eta \quad \text{(Maximum value in our case)}$$

The angle α_o is given by the following equation:

$$(2)\ \tan 2\alpha_o = -\tan(180^o - 2\alpha_o) = -\frac{KT}{CK} = \frac{I_{xy}}{1/2(I_x - I_y)} = \frac{2I_{xy}}{I_y - I_x}$$

which is identical with the equation given in courses in strength of materials.

4. LOCATION OF THE NEUTRAL AXIS

The trace of loading plane is passing through the centroid "O" and intersects the circle of inertia in the point "L", Figure 6. Line LT intersects the circle of inertia at point "N". Then, a line drawn through the points "O" and "N" is the neutral axis $x_n x_n$.

Proof:

With respect to the cartesian system of coordinates xoy, the coordinates of the point "T" are:

$$x_T = KT = I_{xy}$$

$$y_T = OK = I_x$$

now:

$$\angle xox_n = \beta = \angle NDO = \angle NLO$$

and:

$$\angle DNO = 90^o$$

therefore:

$$ON = OD \sin\beta = (I_x + I_y)\sin\beta$$

the coordinates of the point "N" are:

$$x_N = ON\cos\beta = (I_x + I_y)\sin\beta\cos\beta$$

$$y_N = ON\sin\beta = (I_x + I_y)\sin^2\beta$$

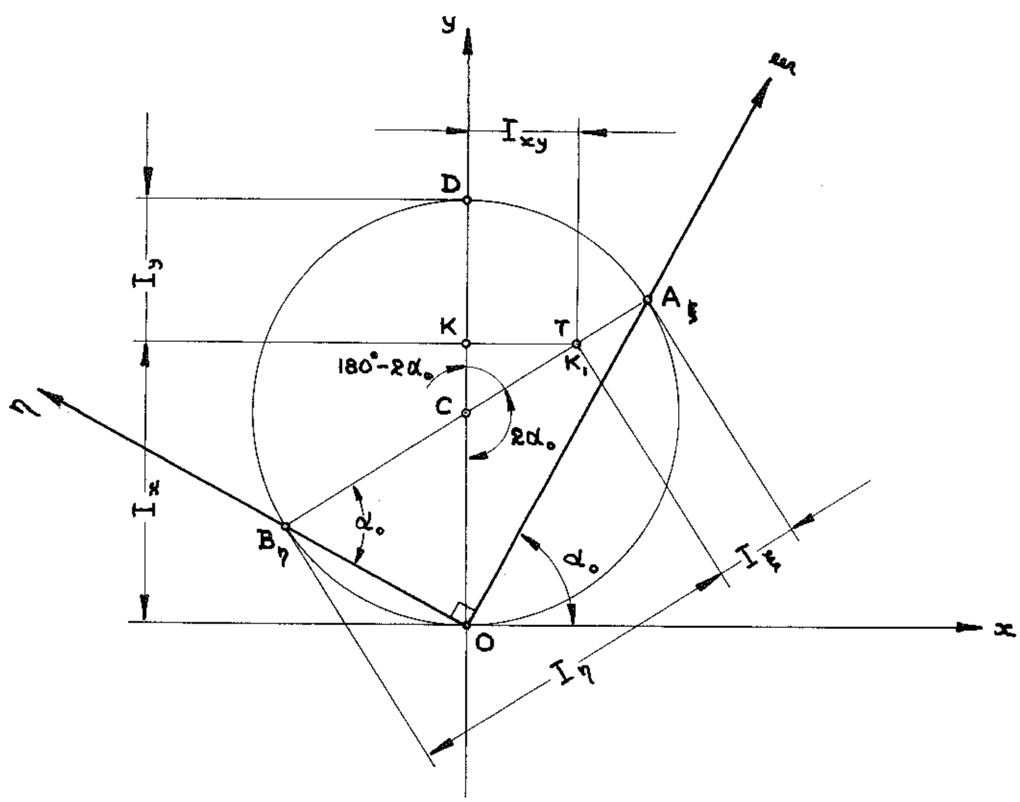


Figure 5.

the angle of inclination of the line TN to the axis xx is given by:

$$(3) \qquad \tan \;=\; \frac{y_T - y_N}{x_T - x_N}$$

$$= \frac{I_x - (I_x + I_y)\sin^2\beta}{I_{xy} - (I_x + I_y)\sin\beta\cos\beta}$$

from the Figure 6 we have:

$$\angle LDO = 90^o - \phi = LNO$$

and

$$\angle PNO = 90^o + \phi = \epsilon - \beta$$

thus:

$$\tan(90^o + \phi) = \tan(\epsilon - \beta)$$

or:

$$(4) \qquad \tan\phi = \cot an(\epsilon - \beta) = \frac{1 + \tan\beta\tan\epsilon}{\tan\beta - \tan\epsilon}$$

substitution into equation (4) of the value of $\tan\epsilon$ as given by the equation (3), yields

$$\tan\phi = \frac{1 + \dfrac{I_x - (I_x + I_y)\sin^2\beta}{I_{xy} - (I_x + I_y)\sin\beta\cos\beta}\tan\beta}{\tan \; - \dfrac{I_x - (I_x + I_y)\sin^2\beta}{I_{xy} - (I_x + I_y)\sin\beta\cos\beta}}$$

$$= \frac{I_{xy} - (I_x + I_y)\sin\beta\cos\beta}{I_{xy}\tan \; - (I_x + I_y)\sin^2}$$

$$\frac{+ \; I_x\tan\beta - (I_x + I_y)\sin^2\beta\tan\beta}{- I_x + (I_x + I_y)\sin^2}$$

$$= \frac{I_{xy} + I_x\tan\beta - (I_x + I_y)\sin\beta\left(\cos\beta + \dfrac{\sin^2\beta}{\cos\beta}\right)}{I_{xy}\tan \; - I_x}$$

$$= \frac{I_{xy} + I_x\tan\beta - (I_x - I_y)\tan\beta}{I_{xy}\tan\beta - I_x}$$

$$= \frac{I_{xy} + I_y\tan\beta}{I_{xy}\tan\beta - I_y}$$

and solved for $\tan\beta$:

$$(5) \qquad \tan \;=\; \frac{I_{xy} + I_x\tan\phi}{I_{xy}\tan\phi + I_y}$$

which is identical with equation given in the theory of unsymmetrical bending.

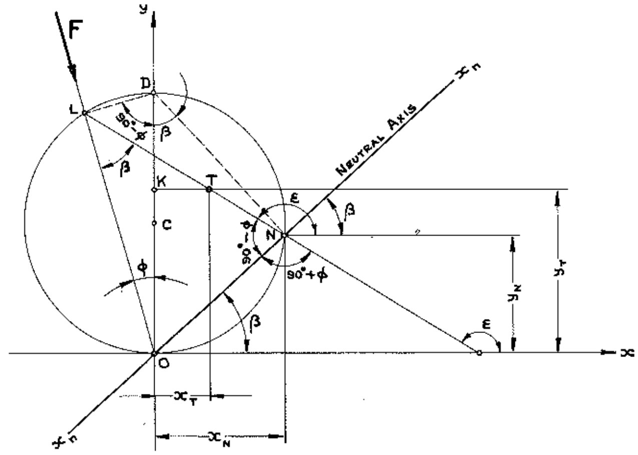


Figure 6.

5. STRESS DISTRIBUTION WITH RESPECT TO THE NEUTRAL AXIS

After the circle of inertia has been con structed and the neutral axis $x_n x_n$ located, Figure 7, draw an arc of radius NT, with its center at point "N", intersecting line ND, which is neutral axis $x_n x_n$, at point "R". Through point "R" draw a line parallel to the neutral axis $x_n x_n$. Select point "f" on the neutral axis and draw a line fe perpendicular to that axis. From the point "e" mark off along the line eg (parallel to the neutral axis) a distance eg representing the applied bending moment M. Then, the line fg represents the stress distribution in the given section.

The stress scale is determined as follows:

Moment of inertia scale : (i) in.^{4} to 1 in.
Bending moment scale : (m) lb-in. to 1 in.
Beam section scale : (1) in. to 1 in.
Stress scale of the stress distribution diagram:

$$(6) \qquad s = \frac{m \times 1}{i}\ \text{lb/in.}^2 \text{ to 1 in.}$$

Proof of the construction

The bending stress σ at any given point in a beam section subjected to oblique bending is given by the equation:

$$\sigma = \frac{M_n}{I_n} \zeta$$

where:

M_n = projection of bending moment vector on the neutral axis

I_n = moment of inertia of the cross-section with respect to the neutral axis

ζ = distance from neutral axis

now:

$$M_n = M \cos \psi$$

thus:

$$\sigma = \frac{M_n}{I_n} \zeta = \frac{M \cos \psi}{I_n} \zeta$$

$$= \frac{M}{\frac{I_n}{\cos \psi}} \zeta = \zeta \tan \rho$$

where:

(8) $$\tan \rho = \frac{M}{\frac{I_n}{\cos \psi}}$$

but:

$$M = eg$$

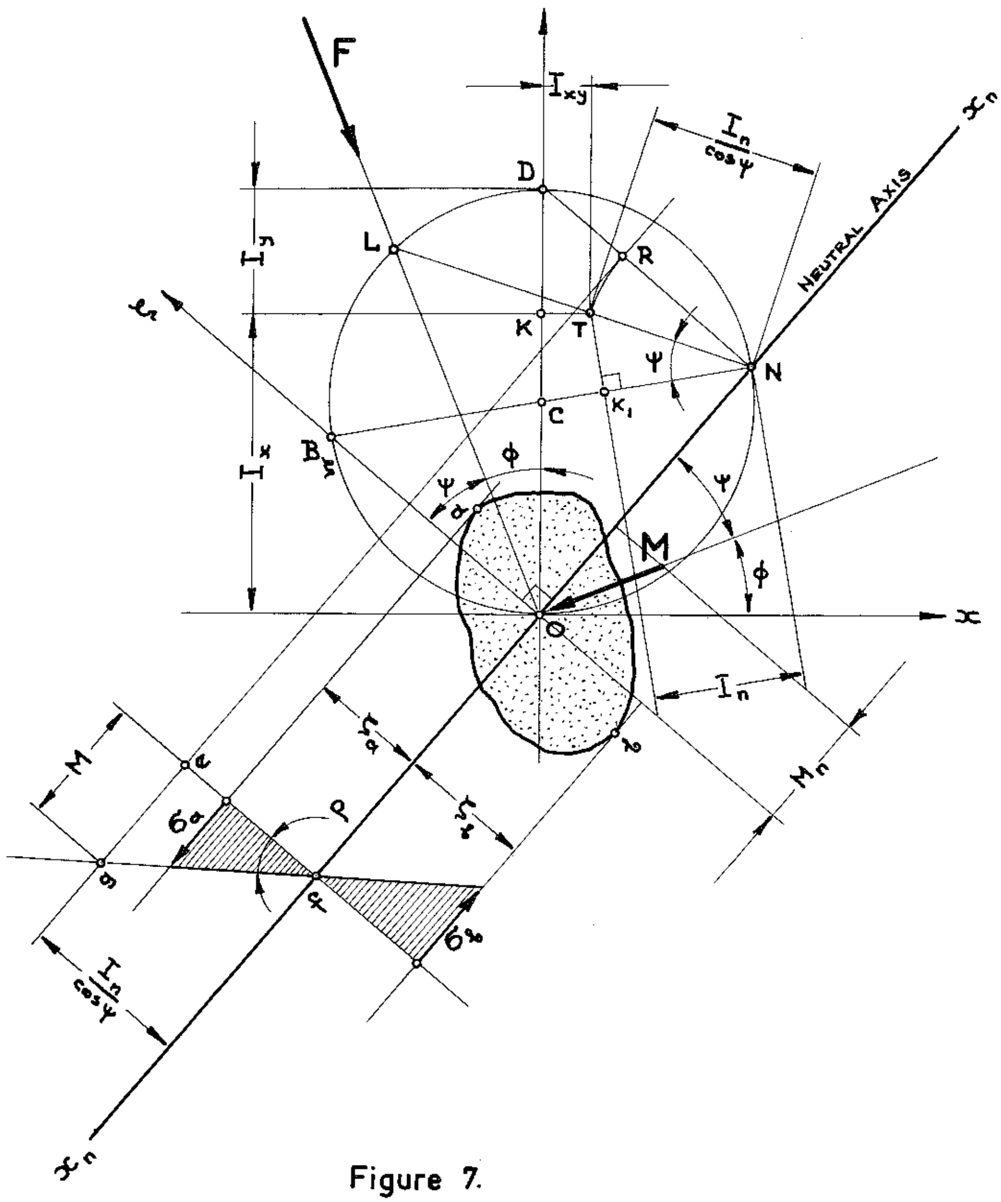


Figure 7.

and:

$$\frac{I_n}{\cos\psi} = \frac{K_1 N}{\cos\psi} = NT = NR = fe$$

therefore:

$$\tan\rho = \frac{eg}{fe}$$

which is the construction used.

Examples:

Given the section profile in Figure 8, where

$$I_x = 1.05 \text{ in.}^4$$

$$I_y = 0.53 \text{ in.}^4$$

$$I_{xy} = 0.495 \text{ in.}^4$$

and

$$\phi = 20^\circ$$

Determine the maximum stress imposed by a bending moment of 5000 lb.-in.

The construction follows the procedure described in this article. Known values are plotted, the circle of inertia is constructed, and the neutral axis and stress distribution are determined. Maximum stress occurs at the corner "a" of the section.

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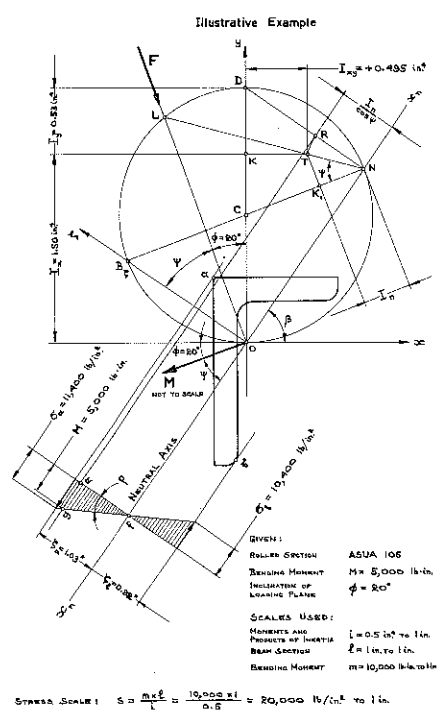

Figure 8

COMPUTER PROGRAMMING - A DESIGN AID

by
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Although engineers should exert every effort to utilize existing computer-aided design programs, they should not automatically reject the possibility of formulating their own. By combining his own special technical skills with available "building-block" programs, the engineers can develop custom programs which will serve as valuable design tools. This paper describes the development of such custom programs for use in computer-aided circuit design; however, the principles are applicable to many other applications.

Few people will question the concept that the full potential of computers should be used by engineers to help solve their various engineering prblems. However, many people limit their thinking to mean that an engineer should use available programs in which he merely supplies the input data in a rather inflexible format. And of course he should ..... provided that an available program meets his needs.

But what if such a program does not exist? As an example, consider what an engineer can do when an oscilloscope will not meet all of his needs. Usually, he will not have expert knowledge of every detail of the oscilloscope. However, if he has a good working knowledge of the oscilloscope and its capabilities, he will be able to build an external circuit which will extend the range of the test equipment to meet his requirements. So it is with the use of computers in design. The engineer should be able to modify or make additions to certain special purpose computer programs to increase their usefulness to him. To do this he needs to develop a familiarity with Fortran and he must not hesitate to call upon professional programmers for initial guidance.

Special Programs Can Be Developed

If the engineer finds that no available program can be easily modified to satisfy his needs, he can revert to using programming subroutines. These are virtually complete programs which can be used as building blocks to build a larger comprehensive program. For example, if a special-purpose program is required, the circuit engineer can combine his circuit knowledge and analytical ability with existing programs that perform numerical integrations, solve simultaneous equations, and provide graphical printouts. Although this approach is not being recommended as a normal engineering procedure for the design engineer, there are situations when it should not be automatically rejected.

During the design of some P-MOS integrated circuit arrays, for example, a situation arose in which a special-purpose program had to be developed. Breadboarding with discrete transistors appeared to provide only second order accuracy in predicting array performance, while designing the circuits and then waiting several months for delivery of arrays involved too much delay time. A computer-aided design program with a built-in model for the MOS devices was needed that could be used to analyze a general P-MOS circuit.

Initially, the various programs available were checked to determine if one were suitable for the P-MOS analysis. The ECAP program was rejected as unsuitable for large signal transient analysis because it is not capable of handling nonlinear components such as voltage dependent capcitors. Other programs that were designed for transient analysis, such as Net 1 and Circus, contain built-in bipolar models and are therefore not suitable for MOS circuit analysis. A remaining possibility was a program such as Sceptre which has transient analysis capability and can accept any type of model. However, a program like this, which even if it were capable of running on the Spectra machine, and presently it is not, requires a great deal of houskeeping even for small problems. For example, compiling time may take from five to seven minutes on the IBM 7090, independent of the problem size. In addition, programs of this size discourage making any modifications to introduce capabilities and features that may be useful or even required for certain problems.

Because none of the available programs appeared to meet our requirements, the only alternative was to generate a special program. First to be determined was the overall capability required of a program of this type. Since, in general, we are interested in a range of circuit configurations, it was desirable that the program be capable of accepting the circuit in the normal topological form that the engineer uses and be capable of generating the appropriate equations. The program had to have the capability of solving these equations and performing a transient solution based on the equation.

Using Program Building Blocks

The generalized building blocks for the circuit analysis program used in our P-MOS design effort are shown in Fig. 1. Block A represents the various steps that an engieer will ordinarily take to define his problem, whether or not computer techniques are used. Blocks B and C are mathematical techniques not ordinarily performed manually by an engineer (except for relatively simple problems); however, the blocks can be solved by computer, using debugged programs that are generally available. The desired output of the computer is represented by block D.

Because the programming requirements for blocks B and C can be implemented by available subroutines, the engineer's primary concern is implementing blocks A and D. A natural apprach would be to implement block A such that the computer program will accept any general circuit topology containing MOS active devices and generate the appropriate set of differential equations that describe the circuit. One of the many ways to do this is to mechanize in the minutest detail the individual steps that the engineer follows in writing the equations, except, in this case, the equations themselves are written in the most general terms.

The key portions of the program written for the transient analysis of MOS integrated circuits, using the basic format described in Fig. 1, are shown in Fig. 2. The lettered blocks in Fig. 2 correspond to the blocks in Fig. 1. Fig. 2 also contains a main program block. This main program treats all previously written programs, as well as the new ones, as subroutines and effectively integrates them into a single comprehensive program. Use of this format facilitates adding new subroutines as well as modifying the present ones.

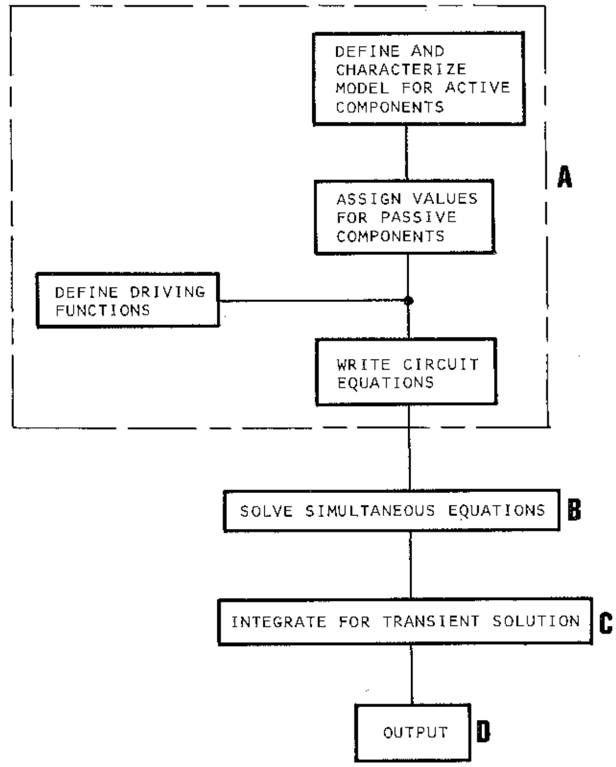

Fig. 1

Generalized building blocks for P-MOS circuit analysis program.

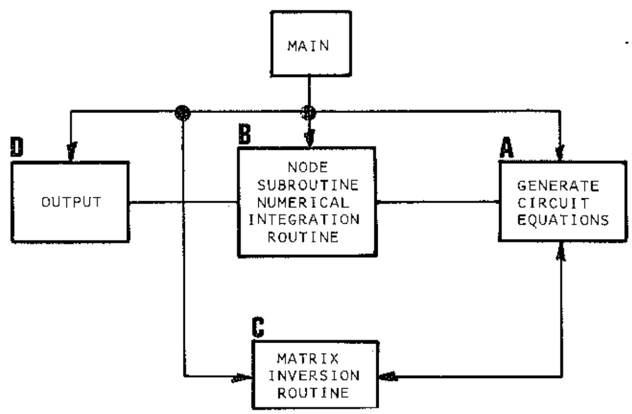

Fig. 2

Key portions of transient analysis program for P-MOS integrated circuits.

As noted, block A, which generates the circuit equations, is the portion of the program that the engineer has to implement in detail. This block recognizes the various circuit configurations and devices and generates a set of first order differential equations describing the circuit. A detailed flow chart of this program is included in Reference 1. It shows how the general equations were formulated for the P-MOS design effort by making a detailed analysis of each node, determining the components attached to each node, and then writing a set of defferential equations. The format of these equations must be compatible with the input requirements of the numerical integration routine.

The Node subroutine in Fig. 2, block B, is a complete program written by the Laboratories for the solution of a set of first order defferential equations.[2] It was incorporated into the overall P-MOS program without any modifications. The matrix inversion routine in block C was taken from a standard text book and used in the program without modification.[3]

Checking Program Accuracy

Once the mechanics of assembling the program are completed, the accuracy of the program is considered. Program accuracy is usually limited by the ability of block A (Fig. 2) to faithfully describe the circuit in two fundamental ways. First, the various active and passive devices must be characterized so that their properties can be incorporated into the differential equations. This characterization usually involves a model that contains lumped or distributed parameters, or is described by a set of mathematical equations.

The use of a model becomes increasingly difficult for large-signal nonlinear devices, especially in an integrated circuit array environment where process techniques influence the characterization of passive devices as well as active devices. For example, consider the voltage dependency of the nonlinear junction capacitances, one of the most important passive devices that must be considered in both bipolar and MOS modeling. If the junction is an abrupt one, as in the case of an alloyed junction, the capacitance varies as

$$\frac{1}{V^{1/2}}$$

where V is the net applied voltage. In modern silicon planar technology, where junctions are formed by diffusion, the exponent of V can vary considerably, although 1/3 is the most common.

The second fundamental way in which the fidelity of the circuit representation must be ensured is in a functional sense. In developing block A, the engineer must include any interactive effects between the components or any special properties or peculiarities of the devices, components or circuits. For example, most P-type MOS devices are relatively symmetrical in their construction and have bidirectional properties. The program, and more specifically block A, must be implemented so as to detect the direction of transistor conduction and to account for the reversal of the current that results from the changing of device terminal voltages. Of course, the corresponding mathematical formulation must reflect these changing conditions.

How accurately the program and, more importantly, the models for the active and passive devices represent the physical circuit must be determined by laboratory correlation. This phase of the development provides the engineer with the opportunity of not only optimizing his representation of the physical problem, but, equally important, of improving his basic understanding of the active and passive devices. It allows him, for example, to ascertain the dependence of device performance on variations in certain characteristics. As an illustration, consider the g_m (transconductance) of a MOS device, a parameter usually assumed to be a linear function of the net applied voltage. This implies that the mobility of the majority carrier is a constant, independent of the applied voltage and the resulting gate field. Laboratory observations will quickly show that the measured current does not follow this ideal relationship over a wide range of applied voltages. A series of computer runs in which variations are introduced in the model to reflect these observations will not only improve the model but also the engineer's understanding of the physical mechanism which determines device action. Even if ordinarily remote from process parameters, an engineer who is reasonably flexible in the use of the computer-aided circuit design program can gain increased insight into the functional dependence of device characteristics on such properties as dopant level by a properly selected set of runs.

Other Advantages of Computer Usage

After the comprehensive program has been developed and verified, its scope can be extended to permit the engineer to determine the various functional relationships between individual components — active and passive — and overall circuit performance. The functional dependence of a particular performance criteria, such as propagation delay, on a single parameter of a single transistor or the variation of all the parameters in the network can be observed quickly and completely. Even with imperfect models for the active and distributed passive devices, a great deal of useful information can be observed. A wide variety of alternative design methods, which otherwise might be completely ignored because of a seemingly low probability of success, can be investigated. In short, the program can be used as an exploratory tool in research and development.

With programs that contain models whose accuracy and reliability can be specified at least over certain ranges, the resourceful engineer can extend his computer - aided design to computer - aided breadboarding. The objective here is to reduce the time and manpower spent on experimental breadboards by quickly converging on the optimum parameter values, before evaluating their performance in the laboratory. Integrated circuits, designed with the use of circuit analysis programs, have been fabricated without intermediate laboratory breadboarding and have produced performances in good agreement with the computer prediction. As an example, the Computer System Research and Application Group of Advanced Technology has recently completed a government contract for the design and layout of MOS integrated circuits. Excellent rsults were obtained using this computer - aided breadboarding approach. This approach is also being used in the area of bipolar circuits, where computer programming is being used extensively to analyze analog circuits with small-signal models. In addition, large-signal models are now being developed by RCA. Another company reports the optimization of their TTL (transistor-transistor logic) computer circuits using computer-aided design techniques.[4]

The flexibility of the also provides the advantage of permitting problems to be attacked in ways not previously possible. For example, the effect of radiation on a circuit might be analyzed by applying the simultaneous impulse driving functions at every voltage node in the circuit and computing the response. Similarly, cooling requirements might be more precisely defined by more accurate thermal distribution analysis, using computer simulation techniques to incorporate as many local heat sources as required.

Concluding Remarks

Whether the application is research and development, circuit analysis, device evaluation and representations, computer breadboarding, design automation, statistical analysis, or worst case analysis, the computer is a tool all engineers should learn to use profitably It is a tool that he can take advantage of through the use of readily available general-purpose programs, or if necessary, through the use of special-purpose custom programs in which he incorporates his special skills and knowledge.

In order to efficiently generate these special purpose design programs, the engineer must have at least a working knowledge of Fortran. He should also seek the assistance of experienced programmers in order to save time in combining the various subroutines into an overall complete program under control of the main program. After theinitial effort of setting up the main program is completed, the engineer will generally find that he can be self-sufficient in handling the remainder of the program tasks.

Finally, the amount of time involved in writing a scientific program should not be a deterrent in inreasing the use of the computer by engineers. The debugging phase of generating a programusually consumes the most time. Even in that phase, however, most of the time is consumed in the turnaround period, i.e., the period from the submission of the program until it has run and returned. Further, when the program is returned, more frequently than not, only a few moments will be required to determine what the next steps in the debugging process will be. Thus, the total programming demand on the engineer's time is small, and he is able to devote most of his attention to his other assignments.

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Mr. Feller received the BSEE from the University of Pennsylvania in 1951 and the MSEE from the same university in 1957. He has earned 12 credits toward a PhD in Electronic Engineering. With the RCA Broadcast Television Group since 1951, Mr. Feller worked as a design and development engineer. In 1958, Mr. Feller transferred to EDP advanced development engineering and became a member of Advanced Technology in 1963. In this capacity he developed high speed circuits and interconnection techniques for proposed new computers. Mr. Feller has been awarded three patents in high speed switching circuits. Recently, Mr. Feller has been applying design automation techniques for bipolar integrated circuit mask artwork generation. In the area of MOS ARRAY, Mr. Feller has been involved in MOS MODEL specifications and in MOS CIRCUIT DESIGN. In this connection he has written a program for transient analysis of P, N or C MOS CIRCUITS.

STUDIES in COMPUTER GRAPHICS at the UNIVERSITY of COLORADO

by
Carl W. Bechtold
University of Colorado

Dr. John Kemeny of Dartmouth is convinced that in the next generation a knowledge of computers will be as important as knowing how to read and write.

Since the computer is useless without programs prepared by man, a great number of men will be required to program and operate the computer. People must also act as liaisons between the computer and businessmen and researchers and politicians; and people must design, manage and service the machines.

The United States is expected to have approximately 220,000 computers by the end of the century. Experts say that one of the most important facts is that too few people become acquainted with the computer for this day and age. After a student has learned something about the computer he will find that using it as a tool is one of the most exciting and rewarding experiences in his education.

Education is a never-ending process. In every profession continuing education and constant upgrading of knowledge are important to counter obsolescence. New ideas, new tools, new techniques and new methods come along to replace older, slower and less powerful ones.

The computer has been one force in the modern world which has done the most reshaping. The computer has accelerated the proliferation of data to thousands of times the amount which man alone can produce. Hardly any field has been left untouched by the computer which is today providing researchers with the most powerful tool ever at their disposal.

Today, the universities, and particulary their students, stand at the dawn of a revolution in education ---- COMPUTER GRAPHICS. Computer Graphics implies a picture implemented by the computer.

In keeping with the graphics recommendations made by the recent ASEE Goals of Engineering Education Study, we, at the University of Colorado, have introduced into our freshman Engineering Graphics program "Studies in Computer Graphics."

During the Fall Semester of 1967 a general introduction to Computer Graphics was presented to 45 freshman engineering students. There was evidence that the students acquired a more comprehensive understanding of graphics and the need and uses of graphics within the framework of an engineering career.

Simple, but basic, concepts were given in sufficient depth to nake a lasting impression. The students had no prior knowledge of computer programming. The initial introduction presented the "control card format" as merely being the "key" to let the student in to use the "services" of the computer. Use of the X-Y plotter was borrowed from the University Graduate School Computing Center. Instruction emphasized the fact that the computer must be "told" exactly what to do just as the teacher must tell the student or the engineer must tell his subordinates.

The first project consisted of a two-dimensional, single view drawing, following precise directions, drawing one line at a time. The relation of this type of drawing to conventional orthogonal drafting and to preparation and use for programming numerical controlled machines was clearly made.

The second project consisted of programming, line by line, the original two-dimensional object into a true oblique pictorial. The students were encouraged to experiment with fixed or variable parameters. Some students revolved and moved their three-dimensional objects through a chosen path, displaying many different views. Others became interested in the microfilm plotter.

The third project consisted of a simple "routine" for drawing borders and trim lines having variable dimensions.

tion The final project consisted of a combination of the preceding with development of a "routine" to draw circles and round corners.

Through the use of film, and computer output, correlation was possible with current applications in industry and possibilities for the future.

Applied Mathematics (AM) 162, a basic course in Fortran programming, is required of all engineering students. The student's involvement with computer graphics stregthens his understanding of the programming techniques in AM 162. The programs developed from a graphical point of view are actually visible to the student, resulting in better comprehension.

During the Spring of 1968 similar material was presented to about 120 students and in the Fall of 1968 to over 500 students.

In order to facilitate the teaching of 25 sections of Engineering Graphics in the Fall of 1968, two lectures were prepared in the form of video tapes in the University Television Library.

The first lecture is 28 minutes long and the second, 22 minutes. The video lectures were shown to two sections of students at a time in a large viewing room beginning at the end of the second week, so that all students will have seen the two tapes by the end of October 1968. Nearly all of the students had completed the program for a two-dimensional object and a three-dimensional oblique before the Thanksgiving holidays. During the latter part of the semester each of the twelve instructors, involved in teaching Engineering Graphics, presented a 30 minute film, to their classes illustrating a number of engineering applications to the Cathode Ray Tube and the use of a light pen and the alphanumeric keyboard and functional keyboard. This film, along with explanations and comments from each instructor, helped to correlate the work that the students had done themselves in programming a simple drawing and relating it to the type of programs and computations being accomplished on the Cathode Ray Tube.

Current developments in digital computer technology suggest the possibilities of new design aids if appropriate programs for communication with the computer are developed.

The availability of the Cathode Ray Tube display - light pen combination along with the alphanumeric and functional keyboards in combination with the digital computer should permit the development of extremely powerful tools which have not been possible before.

At the University of Colorado.such a system (Control Data 280 Display System) is being implemented.

The CDC 280 Display Equipment accepts digital data transmitted from a source and displays it on one or more of the associated Cathode Ray Tubes in the form of symbols (letters, numbers, characters), points (dots), and/or vectors (lines). Our 280 Display System consists of a 280 Display Contoller, a Microfilm Recorder, and a Display Console. Also available is an Off-Line Film Processor.

DISPLAY CONSOLE

The Display Console provides the operator with a visual display of data on a 19-inch Cathode Ray Tube. It contains the tube, a control panel, an alphanumeric keyboard, a switch indicator module and a light pen. The Cathode Ray Tube has a useable master area of 11 1/2" x 11 1/2" and has a coordinate system of 1024 raster points, which is the same as the microfilm recorder.

SOFTWARE PACKAGE (General)

The 280 Software Package interfaces the 280 Display Equipment into the CDC operating system. The package consists of a 280 Driver Program and a set of Central Memory Subroutines. This software provides several types of graph displays (Film Plot Files) and output display data in graph form to the 280 equipment.

The set of Central Memory Subroutines generates the Film Plot Files. These subroutines are Fortran callable and implement the Film Plot Files used for the graph displays.

The Software Pakage can direct data from the print files to the computer system printer, the 280 Display or to both. The graph displays can be plotted on the Display Console and/or stored on film by the Microfilm Recorder.

The set of Fortran callable, Central Memory Subroutines initializes, plots and closes ou the graph displays available to the system.

The microfilming system is available for the students' use. The students who are interested in acquiring additional knowledge about the Computer Graphics are encouraged to prepare programs for the microfilm plotter.

LOOKING AHEAD

In the future, Computer Graphics will provide opportunities for students to interact directly with the computer. As he views a picture of an engineering part or mechanism on the Cathode Ray Tube, he will be able to adjust or change parameters until he has developed a desired configuration prior to preparation of the output drawing on the X-Y plotter or drafting machine with no delay whatsoever.

The equipment will significantly increase the amount and quality of information presented to the students -- in an indirect way by eliminating tedious layout chores which are presently a part of, almost all, design sequences, thus leaving more time for "depth" studies so essential to a design engineer's training; in a direct way, by providing an efficient vehicle for man-computer conversations which will enable a designer to manipulate many more, and significantly more complex parameters and relationships per unit of time than have ever been accomplished in the past. Computer Graphics can reduce design time - with all of its implications - permitting better utilization of a student designer's time.

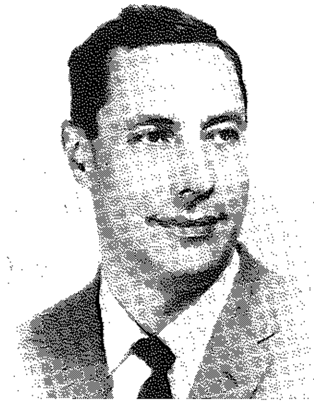
As equipment is developed and organized, and as computer graphics research is translated into practical applications as a device for improving the teaching of engineering design, each design-oriented student will become more efficient in his design project as he use computer graphics' techniques to study and modify his design ideas - allowing better utilization of his time.

Upperclass students will utilize Computer Graphics equipment in engineering design projects, engineering materials, and material selection, optimization techniques and problems, mechanisms, mechanical linkages and programmed instruction. The equipment will provide students with an extremely valuable visual device for presenting and manipulating metallurgical amd materials concepts from a micro-structural standpoint and relating these behavioral aspects of the engineering materials. There will also be an opportunity at the upperclass levels for undergraduate research relative to adaptation of the computer and computer graphics. The entire faculty , within the department, because of the proximity of the computer graphics equipment obtained for this specific use, will have considerably more opportunity to develop programs which will enhance the teaching of their own specific subjects.

Computer Graphics can become one of the most significant teaching devices that students will encounter in their early professional training. Instruction via computer graphics will provide a unique, stimulating, and efficient learning vehicle for teaching students spacial visualization and related principles of orthographic, as well as other types of projection.

The utilization of computer graphics is a good example of the type of teaching presented by Professor Lee Rosenthal, Assistant Professor of Electrical Engineering at Stevens Institute of Technology, in the November 1967 edition of the JOURNAL OF ENGINEERING EDUCATION called "Guided Discovery Teaching in the Engineering Laboratory". Perhaps the weak point in educational processes today is communication; the communication of ideas and methodology. Computer graphics equipment will enhance the ability of the instructor to communicate ideas to the students. The availability of equipment in departmental laboratories will provide improvement in course content and instruction, especially in engingineering graphics.

Summarizing from a letter by Professor Steve Slaby in the October 1968 issue of GRAPHIC SCIENCE, "Computer Graphics or Man-Machine Systems will continue to be further developed and refined thereby increasing the power of graphics as a thinking tool. These systems rely on fundamental graphics which is based on engineering drawing and descriptive geometry. I foresee the engineering graphics field getting more intimately involved in relating its efforts to helping solve some of the serious human and social problems that exist in our country and the world".



LOGARITHMIC SCALE COMPUTER PROGRAM

Clair Hulley
University of Cincinnati

Since logarithmic scales occur so frequently on special slide rules and nomograms it is convenient to have a program to generate these functional scales. This subroutine can also be used to plot the scales for parallel axis charts of the type

$$Z = A*(X)^B*(Y)^C/(W)^D$$

where A, B and C are constants and W, X, Y and Z are variables.

The program is written in Fortran IV using the IBM 7040 with offline feed magnetic tape input to a Calcomp plotter with Calcomp routines:

- (A) Begplt. to rewind tape unit
- (B) Endplt. to save tape and pause
- (C) Chrpwd(n) to allow n alphameric characters to be read as a block. Maximum six
- (D) Char. To print titles
- (E) Number To number scales
- (F) Plot. to draw lines

The call to the subroutine is:

Call Logscl (X, Y, DIR, XMOD, AXMIN, AXMAX, ANGLE)

X and Y are the x and y coordinates with respect to the origan.

DIR is the scale direction:
- -1. to the left or down
- +1 to the right or upwards

XMOD is the modulus of the logarithmic strip in inches.

AXMIN is the smallest x value to be plotted

AXMAX is the largest x value to be plotted

ANGLE is the angle to the horizontal, zero or 90 degrees.

Each call to subroutine logscl results in one data card being read. In columns 1 and 2 a code is carried, followed by the label for the scale.

- +1; scale label is full size and on counterclockwise side of axis
- +2; scale label is double size and on counterclockwise side of axis
- -1; scale label is full size and on clockwise side of axis
- -2; scale label is double size and on clockwise side of axis

FEATURES

The title will be roughly centered along the scale.

The numbers will be shown at standard intervals except terminated where space prohibits, see Example 7.

The numbers will be positioned around the graduation they reference, to eliminate reading errors.

If the numbers are so large or so small as to cause reading problems they are automatically adjusted by a factor of $(10)^n$ which is oncorporated in the title; see Example Four.

Six different tick mark lengths are used, as well as logic, to properly space graduations on the scales for best readability techniques of incrementation.

Tick marks and titles may appear in any of the following ways; (See examples)

Position	Size	Example No.
Below	Full	1
Above	Full	2
Below	Double	3
Above	Double	also available
To Left	Double	5
To Right	Double	6
To Left	Full	7
To Right	Full	8
Any	Any	with exponent in title

Any modulus from 1" to 32" may be used. If a modulus, beyond limits, is used, an error message is printed.

If an angle, other than 0 or 90 degrees, is used, an error message is generated. If an inclined scale is desired, simply supply angular mounting instructions for paper on the plotter. The program will ignore meaningless negative feed of the modulus or the AXMIN or the AXMAX and treat it as positive.

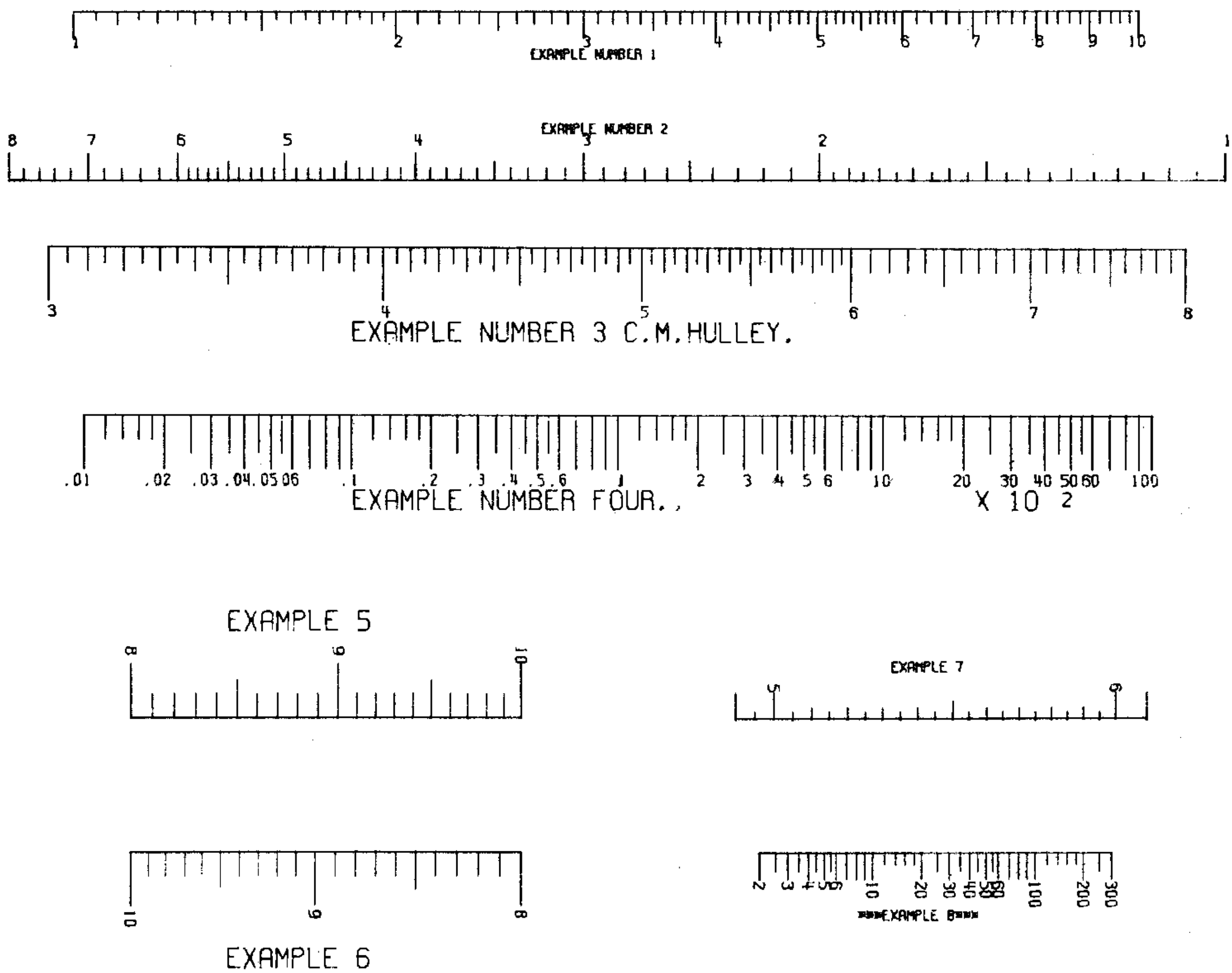
The call Begplt routine is built in on the first call to the sub-program.

Incrementation is done in double precision to increase spacing accuracy on long scales using a large modulus.

If a scale starts at, say, 9. 752 the routine is set to backtrack to 9. and approach from below to obtain a satisfactorily readable next graduation, say, 9.8.

The start and end of each scale is traced at start and continues during graduation so that any paper slippage can be noticed. This is useful when special using special paper taped to the drum.

For checking purposed, during debugging, some cards carry a "C" in column 80 so that they may be reversed and treated as comments when not wanted, but left in the deck for any possible future use in revising the program.



```
$IBFTC MAIN
C PROGRAM TO CONSTRUCT AN ADJACENT SCALE CHART
C FOR THE EQUATION.......
C V*T**0.14= 46.7
C V= CUTTING SPEED IN F.P.M.
C T= TOOL LIFE IN MINUTES.
      TMIN= 1.
      TMAX= 100.
      TLNGTH=6.
      TMOD= TLNGTH /ALOG10 ( TMAX-TMIN)
      VMIN= 46.7 /TMAX**0.14
      VMAX= 46.7 /TMIN**0.14
      VMOD= TMOD/.14
      CALL LOGSCL(2.,2.,1.,TMOD,TMIN,TMAX, 0.)
      CALL LOGSCL(2.,2.,-1.,VMOD, VMIN, VMAX,0.)
      CALL ENDPLT
      CALL EXIT
      END
$ENTRY          MAIN
+2 T= TOOL LIFE IN MINUTES *****FIG.2*****
+2 V= CUTTING SPEED IN F.P.M.
$IBSYS
```

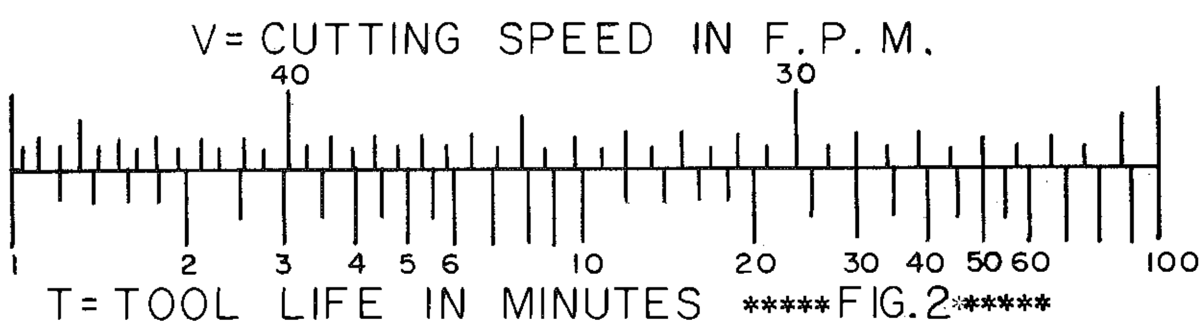


*****FIG.2*****

YES!

I WANT A SUBSCRIPTION TO THE

urnal of engineering graphics

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journal of engineering graphics

To: Professor WILFRED P. RULE
Department of Engineering Graphics
400DG
Northeastern University
Boston, Massachusetts 02115

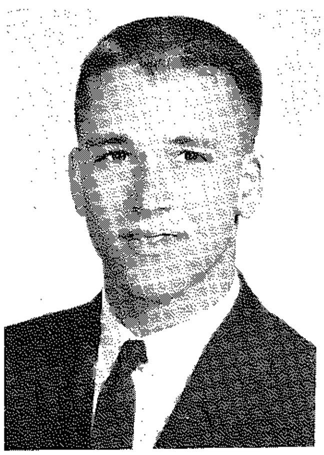
Enter my subscrption to the JOURNAL for:
___1year @ $2: ___2years @ $4: ___3years @ $6

NAME____

ADDRESS______________________________________

CITY and STATE________________________________

ZIP CODE____________



NEW BOOKS

ALLAN CLEMOW
Book Editor

The New Book section is a new feature of the Journal, beginning with this issue. This section wil be devoted to those new books or, in general, publications which are released in areas of interest to the members of the Division of Engineering Graphics.

Hopefully, this section will be able to provide several features for our readers. First, by reviewing material with which they would not, normally, come in contact either by reason of subject area or by level of instruction. A second advantage of the secti on will be a capsule summary of books in basic subject matter, for individuals who niether have the time to read nor order them, but would to have an idea of the content.

It must be stressed that this section will not give opinions, but will be of a report nature to show depth of topics within the publications. The Book Editor does not intend to be a critic, but does hope to present the contents in a manner that will be beneficial for the reader to classify the book as he sees fit.

Publications to be reviewed, will fall into two basic categories; textbooks, which are self-explanatory, and the broad general classification of books and papers in areas which outline the borders of a classical graphics curriculum. Areas, such as Engineering Design, Elementary Computer instruction, and possibly Engineering Orientation, complement the subjects of Engineering Graphics and Descriptive Geometry. These ancillary areas are covered in many first-year Engineering courses and, therefoe, fall into the jurisdiction of our colleagues.

Finally, this section will list additions to the report of the old Bibliography Committee as they are received by the Book Editor. Hopefully, a complete summary of all additions, including books which will have been reviewed in these pages, will be incorporated, as a supplement to the Spring issue of each year. Information concerning publications, which were omitted in the Bibliography, should be sent to the Book Editor for inclusion in the Journal, giving the Title, Author(s), Edition, Year of Publication, Number of Pages and the Price.

ELEMENTS OF DESIGN ENGINEERING,
Joseph P. Vidosic, Ronald Press, 1969, 330 pages.

The author states in the Preface that "this book is intended for courses in design engineering which the interdisciplinary nature of the design function is emphasized." This statement sets the tone for the next 330 pages. Dean Vidosic has taken the design process, explained both it and the necessary nomenclature for understanding these concepts early in the book. He then carefully enumerates the basic theoretical parts which comprise and influence a solution to a proposed need. This includes the mathematical relationships inherent in decision-making theory using statistics and matrix techniques, human factors considerations, reliability methods, optimization techniques plus ancillary topics to help achieve the final solution. Other topics dealt with, show how the engineer must be familiar with, not only the analytical methods of problem solving, but also some of the social, economic, and administrative concepts engendered by engineering. This book, intended for an upper-class course, also has several case studies as examples and proposes some design projects for the reader.

As this type of book, with reference to the basic subject matter, is relatively new in an emerging discipline, it might be valuable to list the chapters by subject heading for the benefit of showing how it is organized.

1. Design Engineering

2. The Design Process
3. Analysis and Synthesis
4. Decision in Design
5. Creativity
6. Aspects of System Engineering
7. Human Factors Engineering
8. Experimantation
9. Reliability Engineering
10. Materials and Processes
11. Design Economics
12. Optimum Design
13. Computers
14. Intellectual Property Protection
15. Engineering Ethics
    Case Studies
    Design Projects

ENGINEERING DESIGN,
William H. Middendorf, Allyn and Bacon, 1969, 286 pages.

This book represents another interpretation of the new discipline of engineering design. Professor Middendorf has developed the chapters and material so that the reader follows the design process chapter by chapter. It is assumed that the reader is attempting to solve a design problem while using the book as a parallel to explain what actions and alternatives the engineer must consider. The topics begin with the definition inherent in the subject, then moves to the building of the design problem by use of engineering parameters or specifications and the feedback feasibility study associated with it. Next, the author presents the motivational methods used to stimulate the conceptualization phase of the process.

Following this is a series of six chapters dealing with the analytical methods available to the engineer. These include decision theory, optimization theory, P.E.R.T. scheduling techniques, modeling methods, reliability, and utility of the computer for design functions. The last chapter briefly discusses other topics which must be explored by the designer to make his solution a viable one for human consumption; human factors, value engineering, production considerations, to name a few.

One of the real pluses of this work is the excellent bibliography and reference guide at the end of most chapters which lists not only the publications but also classifies them as to subject interest. Also the problems and questions related to each chapter are interesting and should provide a good challange for the student. The author's field of Electrical Engineering is made use of by the increased number of questions and sample projects in the area.

PROBLEMS IN ENGINEERING GRAPHICS,
Series VI, A.S. Levens and A.E. Edstrom, McGraw-Hill, 1969, 158 pages (Workbook)

This workbook is keyed to French and Vierck's ENGINEERING DRAWING, 10th edition but also contains reading assignments to TECHNICAL DRAWING, 5th edition by Giesecke, Mitchell, Spencer and Hill as well as BASIC GRAPHICS, by Luzadder 2nd edition. In order to capsulize the coverage, the basic headings will be listed with the number of plates or exercises in each section:

Basic Orthographics	12
Pictorials	23
Descriptive Geometry	17
Developments	4
Sections	6
Fasteners	3
Dimensioning	18
Graphical Mathematics	10

The coverage stresses a utilization of freehand work on grid sheets. Following this is a list of seven open-ended design projects for possible incorporation into the course.

The second part of this workbook includes lettering standards, line symbols, basic graphical construction techniques and exercises of each. The remainder of the book contains extra worksheets; rectangular grid sheets (10), isometric grid sheets (8), plain worksheets (20), and vellum (10).

ADDITIONS to the BIBLIOGRAPHY

ANALYTICAL GRAPHICS,
G.A. Dinsmore; Van Nostrand; 1st edition; 1968; 409 pages; $6.95

WORKBOOK FOR ANALYTICAL GRAPHICS,
G.A. Dinsmore; Van Nostrand; 1st edition; 1968; 159 pages; $4.75

PROBLEMS IN ENGINEERING GRAPHICS AND DESIGN, L.N. Blair, F.A. Mosillo, and H.A. Setton; Stipes Publishing Co.; 1st edition; 1967; 110 pages; $4.50

PROBLEMS IN ENGINEERING GRAPHICS AND DESIGN, L.N. Blair, F.A. Mosillo, Setton

GEOMETRY OF ENGINEERING GRAPHICS, R.O. Byers, and R.L. Turner; Pruitt Press; 1st edition; 1965

ENGINEERING PROBLEMS SOLVING TECHNIQUES, R.O. Byers, and R.L. Turner; Balt Publishers; 1st edition; 1959

ENGINEERING GRAPHICS PROBLEMS, (Workbook); R.O. Byers; News Review; 2nd edition; 1967

STUDENT INVOLVEMENT PROGRAM
(continued from page 37)

Finally, the deduction of the expenses for the Design Display from the operating budget was discussed. Mr. Williams expressed the desire to encourage student participation in A.S.E.E. activities with the possible result of eventually establishing a student Division. He felt that the Division of Engineering Graphics has made some significant inroads toward involving students and asked whether it could be expanded. The plan, as suggested, would be to establish activities to include all engineering students. Although the committee will include representatives from other Divisions, the program would be administered by the Graphics Division. Mr. Williams suggested that the chairman of our Displays Committee be appointed for at least three years and it will be his job to chair the committee for this new project. Professor Slaby was asked to submit a rough draft of a proposal for the project which would be continuous from year to year. This proposal was to include an interim activity for the 1969-1970 school year which would serve as a forerunner to the full-scale project ----- to start in the 1970-1971 school year. When our chairman agreed to submit the propasal, he was informed that the rough draft had to be at A.S.E.E. headquarters before September 28, which was 17 days away, so that funds may be appropriated at the next executive committee meeting of the Society. How would you like to be in Steve Slaby's shoes? However, latest reports indicate that he met his deadline.

After it was agreed that the Division of Engineering Graphics would undertake the project, the discussions concerned the various aspects of the project. Most of the total time that was spent with the executive secretary involved discussion of this new undertaking, in which, he felt, the Graphics Division has shown leadership through its well received Annual Introductory Design Display.

It seems that a new era has come to the society, and we of the Division of engineering Graphics stand ready to cooperate with the executive secretary, Mr. Leslie B. Williams

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ADVERTISERS' INDEX

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ENGINEERING GRAPHICS DIVISION

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MID - YEAR MEETING

CALIFORNIA STATE POLY

SAN LUIS OBISPO

professor wally reynolds

host

JANUARY

1970

DIVISION OF ENGINEERING GRAPHICS ASEE

SAN LUIS OBISPO, CALIFORNIA

MID YEAR MEETING

CALIFORNIA STATE POLY

January 1970

Professor Wallace Reynolds - host