CAST NEWSLETTER

COMPUTING AND SYSTEMS TECHNOLOGY DIVISION

American Institute of Chemical Engineers

CHAIRMAN'S MESSAGE

As I travel in the United States and abroad, it is rewarding to experience the growing significance attributed to computers in chemical engineering. The novelty has worn-off, but challenges increase to make more intelligent use of computing equipment that approaches obsolescence upon delivery. With hardware costs decreasing, in spite of inflation throughout our economy, the option to purchase equipment has expanded for many to include the entire computer as well as peripherals. As predicted, the onus for performance has shifted to software, wherein lies most of the hidden costs and problems of computing. Software systems can grow like a cancer, sometimes out of control, and the trick is to apply the principles of modularization in structuring subroutines and data records to keep the culture in a state of remission.

There are those who acknowledge this problem, but prefer closer proximity to the forefront of problem-solving in chemical engineering. Some seek new developments in numerical methods to extend our knowledge of stiff reactors and processes with complex geometries and coupled differential equations. Others are challenged to apply artificial intelligence and adaptive control to synthesize near optimal flowsheets and control systems.

Whatever your perspective, CAST provides a forum for open discussion of developments as computing technology impacts chemical engineering. The Programming Board under Fred C. Stults is working to maintain the fine precedents established over the past fifteen years. But, the National Program Committee seeks to explore the possibilities for Block Programming at AIChE meetings and our flexi-

bility in offering a mix of sessions at each meeting may be impaired. For this reason, the Area Chairmen - Richard S. H. Mah (15a - Systems and Process Design), Dale E. Seborg (15b - Systems and Process Control), and Michael T. Tayyabkhan (15c - Computers in Management and Information Processing) - are working to develop five-year plans for sessions at AIChE meetings. The plans will be reviewed by the CAST Executive Committee in Boston and a coordinated plan for CAST submitted to NPC. Over the years, sessions were conceived two-three years in advance; so this plan will not greatly extend our crystal balls. At least, it will better enable us to establish our needs for sessions in advance of proposals developed by NPC. Such a plan will be revised periodically, probably once yearly, to reflect new trends.

Other developments in programming include the International Conference on Foundations of Computer-aided Process Design. This one week conference is scheduled for July, 1980 and is described in a separate article. CAST is moving toward one such conference yearly. Area 15b, Systems and Process Control, has initiated plans for the next conference in 1981.

The question of recognition for outstanding contributors in our field has been under consideration for the past year by Mike Tayyabkhan and his Awards Committee. At this time, an award has been defined and a nominating committee organized. The Division Banquet in San Francisco should be our First Annual Awards Banquet. A restaurant on Fisherman's Wharf has been reserved and plans will be announced in the next Newsletter.

You may be wondering why CAST Executive Committee meetings are closed this year. In the past, MCC meetings and CAST meetings

were open. They tended to ramble and included items that are probably best presented in this Newsletter. This year's Executive Committee has a tentative agenda distributed two months in advance of meetings with times assigned for each topic. Many of the topics involve the operations defined by CAST Bylaws. In fact, this year we are working to interpret the Bylaws and will propose amendments with the ballot for election of officers in October. We invite you to suggest topics for consideration and to attend Executive Committee meetings to make a presentation. Please write to me to suggest agenda items.

There are many ways that you can participate in the work of CAST besides attending sessions and reading the Newsletter. All members are invited to help plan sessions by serving on the Area 15a, b or c committees, to write for the Newsletter, to serve on the Awards Committee, etc. Write to me, or to the person most directly involved, if you would like to help.

Warren D. Seider
May 24, 1979

HIGHLIGHTS OF EXECUTIVE COMMITTEE MEETING APRIL 2, 1979, HOUSTON, TEXAS

Warren Seider expressed concern about the impact of electing a new Secretary-Treasurer every year. A proposed Bylaw change to elect the Secretary-Treasurer to a two-year term was unanimously passed. A ballot to change the Bylaws will be mailed to all members with the election ballots around October 1, 1979.

With the election of Dick Hughes as First Vice-Chairman the remaining term of his Director's position was unfilled. The Committee considered several nominations and elected Tom Edgar to fill the remaining term of Dick Hughes' Directorship. Congratulations to Tom.

Mike Tayyabkhan and the Awards Committee proposed that the CAST Division present three annual awards: The primary award to an individual; an institutional award to an academic or industrial institution; and a student award. There was some discussion for an award name for the primary and institutional awards. Mike Tayyabkhan and the Committee are requesting suggestions

for an award name from CAST membership. Mike also suggested that the structure of the Awards Committee be reorganized on an annual basis. Mike will present a Bylaw change to the National Committee at the Boston Meeting. Methods for funding the awards are also being considered at this time.

Pete Hanik suggested that the Bylaws be modified to have the Newsletter publication dates correspond to the National Meeting dates. A Bylaw modification to this effect will be submitted for consideration at the Boston meeting.

Dick Hughes commented that Volume 2 No. 4 of the journal Computers and Chemical Engineering will have 17 papers in it with a publication date of April 30, 1979. Dick is still in need of people to review both articles and books.

Irv Rinard reported that the main concern of CAST's programming board is National's proposal to go to block programming whereby all sessions would be linked together by a common thread in a given area for one meeting. National's actions in this area will have a significant effect on the nature of CAST's programming in the future. Dick Mah, Tom

Edgar and Mike Tayyabkhan all reported that their main concerns are the cutback in the number of sessions from the National Programming Board. Warren Seider proposed that we make a maximum effort at the National Programming level to communicate the needs of the Division to the National Programming Board.

Bob Harris reported that membership was 500 as of March 9, 1979. However, more members are needed if CAST is to continue to grow and become self-supporting. It was suggested that personal contacts would be the best method to promote membership in the Division and volunteer speakers are being recruited to make presentations at local sections.

Warren Seider discussed plans for CAST's Second Annual Division Dinner which is to be held at the San Francisco Meeting in November, 1979.

1980 NOMINATIONS UNDERWAY

CAST's annual election of officers takes place on or about October 1 of each year. At that time, you will receive a ballot to choose a Chairman, First Vice Chairman, Second Vice Chairman, Secretary-Treasurer and two Directors. Their term of office is one calendar year except for the six Directors, who serve for three years with two being elected each year to assure continuity. (NOTE: The Secretary-Treasurer's term may be changed to two years. See article highlighting the Houston Executive Committee meeting-Ed.) Normally, the First and Second Vice Chairmen are the sole nominees for the offices of Chairman and First Vice Chairman, respectively.

A Nominating Committee, formed in April of each year, has the responsibility for formulating a slate of candidates and preparing and mailing the ballots. This year, the Committee members are Vern Sterba (Chairman), Grant Fisher, and Ted Leininger. Any comments or suggestions concerning nominations may be directed to the Chairman. More specifically, the Bylaws state that "Nominations may also be made for any office by petition of the membership if at least twenty Division members in good standing sign a petition and submit it to the Secretary-Treasurer by September 1." Complete details of the election procedure are described in Article VI of CAST's Bylaws

CAST BYLAWS AVAILABLE

If you would like a copy of the Computing and Systems Technology Division Bylaws, send a stamped (2 oz.) self-addressed envelope (9 x 4 or larger) to:

> Vern Sterba
> Northern Natural Gas Company
> Scientific Computing Department-4
> 2223 Dodge
> Omaha, NE 68102
> ATTN: CAST Bylaws

PROGRAMMING SYSTEMS & PROCESS DESIGN (AREA 15a)

Area 15a will be sponsoring 4 sessions at the Boston meeting: Computers in Education and Training, Co-Chairmen G. R. Marr and R. W. Southworth; Process Synthesis and Methodology, a Critical Evaluation, Co-Chairmen, H. D. Spriggs and J. Dirola; Finite Element Methods, Co-Chairmen, S. W. Churchill and B. Finlayson. There was such a strong outpouring of papers for the session on finite element methods that a second session was scheduled. In addition, Area 15a and Area 3a are co-sponsoring 2 sessions on Modeling of Fossil Fuel Processes, Co-Chairmen L. M. Naphtali and J. Wei.

The session titled, Process Synthesis Methodology, a Critical Evaluation will consist of two review papers followed by a panel discussion. In the first paper an overview will be presented of the computerized synthesis techniques currently being used by the chemical process industry. Data for the paper have been gathered through telephone conversations and follow-up questionnaires involving representatives from over 30 major companies and over 10 academicians. In the second paper a case study will be presented detailing how process synthesis techniques have been implemented by one company. The panel will feature both academic and industrial speakers.

Upcoming for the San Francisco meeting, November 26-29, 1979, Area 15a is sponsoring one session in personal computing, three sessions on advances in modeling and analysis of chemical engineering systems.

COMPUTERS IN MANAGEMENT AND INFORMATION PROCESSING (AREA 15c)

Area 15c is sponsoring a session on Computers in Production and Inventory Control at the Boston meeting. In the era of cheap feedstocks, materials and energy, the chemical process industries were relatively unconcerned with production and inventory control methods. Today this is no longer true due to the changes which have taken place in our economy. Today, as much as 20% of a firm's assets can be tied up in inventory. Effective management of inventory has become an area of critical concern.

Papers being presented include

Inventory Management in the Chemical Process Industries: A Survey,
S. G. Taylor
University of Wyoming

PIC/PAR, A Decision Support System For Production Planning And Inventor Control,
F. F. Seglig
Mobil Oil Corp.

Material Requirements Planning In The Chemical Process Industries: A Case Study,
R. L. Cohen and L. Zeftel,
E.I. duPont de Nemours

Applications Of Logistics Planning Techniques At EXXON CHEMICAL CO.,
P. A. Tomlinson,
Exxon Chemical Co.

This session is being Co-chaired by S. G. Taylor, College of Commerce and Industry, University of Wyoming and N.E. Rawson, IBM Corp.

WHITHER CAST PROGRAMMING?

There has been considerable debate in CAST circles over the past few months concerning the types of programming that should or should not be provided at AIChE meetings. Primarily at issue is whether or not papers describing practical applications of various computational methodologies are a legitimate component of CAST programming.

The debate has been sharpened by the National Program Committee's attempt to limit the total number of sessions at each meeting. This and other developments have conspired to reduce the total number of sessions available for CAST programming. This in turn has increased the competition for sessions and heightened the debate as to what sorts of papers are suitable and what are not.

One point of view holds that the limited amount of programming time available should be devoted primarily to the presentation of the latest results in the area of applied mathematics and computational methodology; that the division's main obligation is to present material of direct interest to full-time practitioners of the computing arts. Another point of view holds that CAST's obligations are broader; that part of the programming time should be scheduled for papers describing the results obtained when new methods are applied to real problems.

In fact these two types of papers are just part of a spectrum of the kind of presentations that CAST should try to organize. At least four categories come to mind. The following is a brief description of each, the types of people to which each might appeal, and some of the pitfalls associated with each.

1. The State-of-the-Art Paper

The majority of CAST papers have been and should continue to be of this type for it is the presentation of new methods, algorithms, and techniques that are the lifeblood of our field. However, we must keep in mind that these are papers that appeal primarily to specialists. The results presented tend to be fragmentary; few arrive at a complete solution to the problem treated. On the other hand, since most are the result of academic research, there is no dearth of supply, a nontrivial consideration to one organizing a session.

2. The Evaluative Paper

In this type of paper a technique or class of techniques are compared generally by application to typical, hopefully realistic, problems. Of particular interest are "practical" applications, i.e., applications to actual industrial or other "real" situations. The audience for this type of paper is potentially much greater than that for state-of-the-art papers. There are, for instance, far more engineers involved in designing distillation columns via computer

than in developing the computer programs with which to design them. Such papers are relatively hard to come by since most evaluative work is done behind corporate walls and is likely to be considered proprietary.

3. The Survey Paper

The survey paper attempts to sum up in a comprehensive form the progress that has been made in a selected area such as process simulation or multivariate control. The potential audience for this type of paper is also quite large compared to the state-of-the-art paper since there are generally more people interested in a particular area than have time to keep up with it in detail, let alone sort out all of the developments. Good versions of this type of paper are hard to come by since it is more difficult and generally less rewarding to put together a panorama rather than a snapshot. Also, such papers can easily become little more than annotated guides to the recent literature.

4. The Tutorial Paper

The tutorial paper is intended as an introduction to a particular topic or area. While it would seem that most tutorial presentations are best left to the Continuing Education Program, an occasional tutorial on the rudiments of a topic to be covered in more detail in other papers in the same session or meeting may be of interest.

Few papers will fall neatly into one of these four categories. Most are mixed in form. One seldom presents new results without referring to prior work. Practical applications often require extensions of the general methods being applied. And so on.

The National Program Committee is presently considering a block programming concept at national meetings. Block programming will specify a general topic for all papers presented at a meeting. Thus, all sessions will be linked together by a common thread. With the emphasis now being placed on block programming, it can be argued that a meeting program should consist of a mixture of several types of papers. The opening session might be a survey of the block topic with perhaps a touch of the tutorial. The next four or five sessions would be a blend of new results and evaluations or practical

applications. The final session might involve a panel or roundtable discussion of where things are headed and what needs to be done. This format should help to attract more people to meetings as well as meet CAST's obligations to the general membership as well as to its own members.

12th SYMPOSIUM ON COMPUTER APPLICATIONS IN CHEMICAL ENGINEERING

In April, nearly 300 persons assembled in Montreux, Switzerland for the 12th Symposium on Computer Applications in Chemical Engineering. The technical program chairmen, Professor David W. T. Rippin, ETH-Zurich, Switzerland, and Dr. R. Lierau, F. Hoffman-LaRoche & Co. AG, Basel, Switzerland, deserve congratulations for having assembled a fine program comprised of 13 sessions and 115 technical papers.

At registration each attendee was presented with the Conference Proceedings, including copies of most papers. Copies can be obtained by writing to:

Association & Convention Management
Box 158
1800 Vevey
SWITZERLAND

For me, the symposium was highlighted by the presentations of three rapporteurs: Professor Roger W. H. Sargent of Imperial College on "Flowsheeting", Professor O. A. Asbjornsen of the Technical University of Norway, Trondheim, on "Project Evaluation" and "Safety and Reliability", and Professor Rololphe L. Motard of Washington University on "Process Synthesis". Each rapporteur reviewed the subject and presented his views concerning the papers. But, unfortunately, these remarks are not included in the Proceedings.

There were three sessions in parallel throughout most of the symposium, with the large majority of attendees at sessions on Flowsheeting and Process Synthesis. For me, the Proceedings were very helpful, permitting a prescreening of sessions and papers likely to be thought-provoking. Others probably did the same and, unfortunately, sessions on Advances in Model Building and Mathematical Methods and Optimization were poorly attended. Other sessions included Project Evaluation, Unit Operations, Safety and Reliability,

Design and Operation of Batch Processes,
Process Control by Computer, Integrating
Development, Data Bases and Library Programs,
and Education. I did not attend many of
these sessions, either because they were
too far afield, or appeared to be sparse in
strong papers. Perhaps 13 sessions in 3
days are too many to organize with substan-
tial advances in our field? Perhaps the
bulk of attendees preferred to emphasize
Flowsheeting and Process Synthesis? Perhaps
there were too many parallel sessions? The
organizers would do well to consider these
questions as they plan for the 13th
Symposium in Budapest, Hungary - September,
1980.

NPRA COMPUTER CONFERENCE

Did you know...that in October of each year,
the National Petroleum Refiners Association
conducts their 3 day Computer Conference?
A recent mini-survey within CAST indicated
that many of CAST's members are unaware of
the existence of this conference, in spite
of the fact that it is aimed at the computer-
oriented practitioner in the petroleum and
petrochemical industries.

The 1978 conference in Anaheim featured ses-
sions such as "Computer Simulation Modeling"
and "Microprocessor Applications". The 1979
Conference, scheduled for October 29-31, in
St. Louis, includes sessions such as "Comput-
ing - State of the Art," "Probability
Analysis in Process Operations," "Process
Control," plus a tour of one of Monsanto's
Computer Control Systems.

Conference details can be obtained from:

E. Lloyd Powers
NPRA
1899 L Street, N.W.
Suite 1000
Washington, D.C. 20036
(202) 457-0480

INTERNATIONAL CONFERENCE ON FOUNDATIONS
OF COMPUTER-AIDED PROCESS DESIGN

Professors Richard S. H. Mah and Warren D.
Seider are planning for the first Inter-
national Conference on Foundations of
Computer-aided Process Design. The Confer-
ence, a project of CAST, will be held from
July 6-11, 1980 in Henniker, New Hampshire.

The Engineering Foundation will handle regis-
tration and physical arrangements at Henniker.

Since the last Newsletter, an advisory
committee met to review a preliminary agenda.
Professors Mah and Seider are presently
preparing invitations to Session Chairmen.

Eight sessions are planned to run in series,
with each session featuring a "State-of-the-
Art Review" by one of the leading experts and
invited papers describing 3 or 4 recent
advances. All reviews and papers will be
published in a Conference Proceedings, along
with session summaries to be prepared by
Reporters who will place the contents of the
sessions in perspective.

Funds have been requested from NSF and pre-
liminary feedback is good. If our proposal
is accepted, travel expenses will be covered
partially for speakers.

UPDATE ... DATA BANK OF PROFESSOR ROBERT REID

In the March 1979 CAST Newsletter it was
mentioned that the physical property data
bank for some 468 organic and inorganic
chemicals was being made available via the
ASPEN project at MIT from the book 'The Pro-
perties of Gases and Liquids' by Robert C.
Reid, John M. Prausnitz, and Thomas K.
Sherwood, McGraw Hill (3rd Ed) 1977.

Feedback has indicated that there has been
some confusion surrounding requests for
the data base. These problems have been
discussed with Paul Gallier at MIT.

Those interested in the data bank for use on
their digital computers should direct their
inquiries in writing to:

Ms. Jean Gerlach
IPS, Bldg 39-427
Massachusetts Institute of Technology
77 Massachusetts Avenue
Cambridge, MA 02139

The data bank is available in two forms:

- Card version at a cost of $60,
  including a printed listing.

- Tape version at a cost of $45,
  including a printed listing. The
  tape version is in EBCDIC code

blocked at 25 lines in either
800 or 1600 bpi tape densities.

Checks should be made payable to Massachu-
setts Institute of Technology.

AMERICAN CHEMICAL SOCIETY .. COMPUTERS IN CHEMISTRY

The National Resources for Computers in
Chemistry (NRCC) Bulletin can be obtained
by writing NRCC c/o Lawrence Berkeley
Laboratory, Bldg 50 - Room 208, Berkeley,
CA 94720.

The April Bulletin (#1 Vol II) describes
miscellaneous workshops and activities for
1979. Bulletin #5 Vol I, published in
December 1978 gives a listing of the com-
puter programs available for computational
chemistry.

AMERICAN PRODUCTION INVENTORY CONTROL SOCIETY

The American Production Inventory Control
Society (APICS) has funded the development
of a document to define the state of the
art materials management system framework
for the process / flow shop manufacturing
environment. The report will detail the
proceedings of a three day workshop (June
14-16, 1979 in Golden, Colorado) composed of
leading practioners from a variety of pro-
cess / flow shop industries. The workshop
results will be presented at the APICS
National Meeting October 16-19, 1979 in
Saint Louis, MO.

Several of the workshop Colorado partici-
pants will be presenting papers at the Fall
AIChE Meeting in Boston, Massachusetts. The
session (#10) is titled 'Computers in
Production and Inventory Control', and will
be held August 20th, 1979, 8:30-11:30 a.m.

OPTIMIZATION CRITERIA
FEATURE ARTICLE
BY
ED GORDON

An alternative which is optimal with respect to one criterion, such as lowest cost, may be far from optimal with respect to other criteria such as maximum profit or minimum adverse effects on the environment. When you use an inappropriate criterion for an optimization you solve the wrong problem.

In the last few years, energy costs have increased dramatically and further increases are likely. Most costs and prices have demonstrated a strong upward trend since the 1930's. Yet, few Chemical Engineering studies allow for the effects of inflation in their determination of the "optimal" Process Design. Appropriate selection of the optimization criterion can insure the inclusion of this significant factor.

The simplest and best way to allow for the effects of inflation is to use Net Present Value of the cash flows as the optimization criterion. Many Engineering Economics texts call the concept "Present Worth". It is a way to compare a cash outflow today with a cash inflow at a later date. The cash available today can be invested to produce a greater sum at a future date. For example, one can invest $10,000 in a Treasury Bill for six months and earn an interest rate close to 10 percent with no risk. The equation relating a present value, P_0, with the corresponding value n years later, P_n is

$$P_0 = P_n/(1 + i/100)^n \qquad (1)$$

where i is the annual interest rate expressed in percent the investment pays for the funds it uses. This is often called "allowing for the time value of money".

Similarly, a sequence of future payments has a present value. That present value depends upon the rate of return you think the investment should provide to the suppliers of the funds used. When we are dealing with payments which grow at a constant annual inflation rate, g, percent per year, the present value of the sequence, P_1 to P_n can be expressed as follows:

$$P_0 = \sum_{j=1}^{j=n} P_j X^j \qquad (2)$$

where the factor X includes both the annual growth due to inflation and the discounting of a future value to its present value so that

$$X = (1 + g/100)/(1 + i/100) \qquad (3)$$

The net present value is simply the difference between the present values of cash inflows and the cash outflows. Construction costs are too often assumed to be a cash outflow on one day and on the next day, there is a plant producing on-specification product at full plant capacity. In today's economy, the delays between the analysis which procedes an investment decision and the existence of a plant operating at design capacity normally are substantial. Few Nuclear Power Plants have been finished with a delay of less than 10 years. Observation shows that LNG and nuclear waste processing facilities in the U. S. take much more than 10 years from process definition until construction is completed.

Recently, construction and energy costs have been increasing more rapidly than the general inflation rate. As long as this continues, the net present value of construction and energy costs will increase more rapidly than the present value of the anticipated future revenues. This tends to make the investment less attractive than it would be with shorter delays between the analysis preceding the decision and completion of construction.

Those of you who have been through MBA courses have been taught to assume that all cash flows which occur within any year occur on the last day of that year and that financing considerations should be ignored. Yet, the revenue and some of the expenses generated by most investments are paid monthly. Other expenses range from quarterly to only once per year. When unplanned delays are likely or the project being considered is going to cost in excess of one billion dollars, ignoring financing can introduce errors involving substantial dollar amounts.

Income taxes, both Federal and State, are

also frequently omitted. Yet, for most
major firms, these income taxes are compar-
able with and often do exceed the residual
left after paying income taxes for the owners
of the firm, the Stockholders.

The above discussion can be illustrated in
terms of the classic "Insulation Optimization"
problem. The basic question is what thick-
ness of insulation is optimal for a given
pipe wall temperature and insulation
characteristics. For this problem, a rela-
tively general solution was published in
1966. The optimization criterion was written
in terms of a "total annual cost":

$$C_{ta} = Z*C_u + Q*A_L*C_F \qquad (4)$$

where A_L = outside area/foot of length

C_F = annual cost per BTU/hour of
heat lost

C_u = unit cost of insulation

Q = heat loss/square foot

and $Z = Y [1/D + (1/P-1/D)/(1-R)]$ (5)

where D = depreciation life, years

P = desired payout period (after taxes)

R = income tax rate

Y = adjustment factor for location
differentials

Buried in the CF is the thermal efficiency
of the boiler or fired heater as well as a
marginal cost for additions to heater
capacity required to compensate for a greater
heat loss. However, inflation and the time
value of money are ignored and straight
line depreciation is used in this calcul-
ation even though few companies use it in
computing their income taxes.

A new optimization criterion has been develop-
ed for this problem based on the net present
value of all of the relevant cash flows,

$$J = C*F1 + Q*F2, \qquad (6)$$

where C = estimated installed cost of the
insulation, in Dollars per foot
of pipe at the plant location

Q = hourly heat loss through the
insulation per foot of pipe

$F1$ = factor which discounts the cost
of the insulation inflated to the
time it is installed and then dis-
counted to its present value when
the analysis is made. The factor
includes the present value of
expected future maintenance costs
less the present value of the effect
of accelerated depreciation and
Investment Tax Credits on the income
taxes paid by the firm.

$F2$ = cost factor for present value of
future monthly payments for energy
costs on an after tax basis plus
the present value of the incre-
mental cost of additional heater
capacity with due allowance for
investment tax credit and the effect
of accelerated depreciation on
future income tax payments. The
thermal efficiency is included in
determining the value of F2.

In many practical situations, the parameters
which are varied during the optimization
procedure do not affect the values of factors
such as F1 and F2. Then the values of these
factors can be properly determined by a
detailed analysis and then used over a
variety of conditions.

A 10 percent rate of return on investment is
a reasonable estimate for the discount rate
to use if you do not have any better infor-
mation from the client involved. There are
few industries in the United States which
are still able to achieve a significantly
higher rate of return on investment. However,
it is the return on equity which induces
investors to accept the risks inherent in
ownership of the firm. Return on equity
should be significantly higher than the rate
of return on risk-free investments as well as
the total return on investments.

The criterion suggested in this article pro-
vides a better approximation to economic
realities than the criteria usually used in
optimizations. Nevertheless, it does not
include many considerations which can be
important to picking the "best" solution.
There are intangibles such as the morale of
employees confidence of stockholders,
dissatisfaction level of environmental and
ecological activists, and the likely deviations

of the future real world from the model
assumed. One danger inherent in any comput-
erized optimization is the fact that it
usually ignores the intangibles so that the
solution is only "best" for the conditions
and assumptions you have used.

Biographical Note:

Edward Gordon is a Principal Process
Engineer at Fluor Engineers and Constructors,
Inc., Southern California Division, Irvine,
CA. In addition to his B.CH.E (1943), and
an M.A. in Mathematics (1955), he has a
PhD in Business Economics (1970).
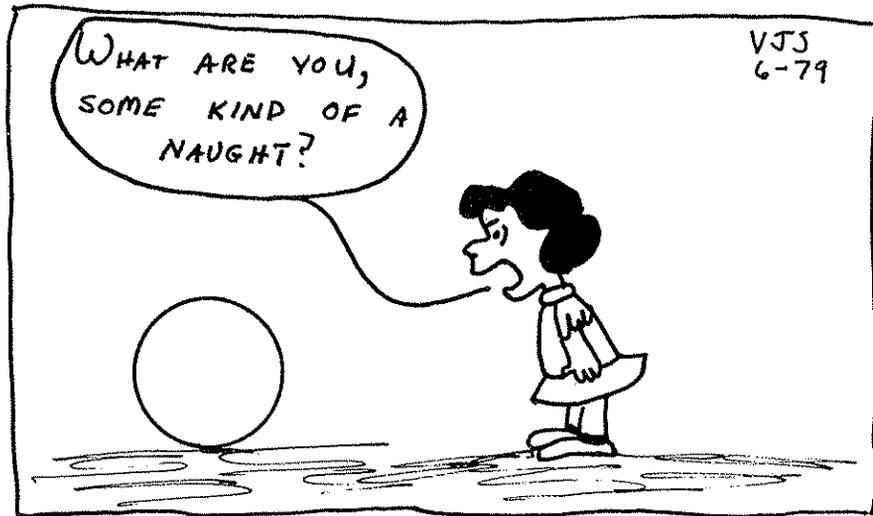
The above cartoon was supplied by Vern
Sterba. My passion for puns made it almost
irresistable. I hope that the Newsletter
will be able to stimulate your imagination
and tickle your funny bone in the future,
but I have a problem. As an engineer Vern
is outstanding but I'm afraid his abilities
as a cartoonist may already be totally
depleted. If you are a member of CAST with
a bizarre mind, an artistic flair and a
willingness to depose Vern as our cartoonist,
please contact

Pete Hanik
Northern Petrochemical Co.
P. O. Box 459
Morris, IL 60450
(815) 942-7011

COMPUTING & SYSTEMS TECHNOLOGY DIVISION

AIChE

Membership Application.

I wish to join the CAST Division of AIChE. My dues payment of $3.00 is enclosed.

NAME _____

ADDRESS _____

_____

_____

EMPLOYER (IF NOT IN ADDRESS)

_____

My two primary areas of professional interest are:

_____

_____

(NOTE: Sections devoted to specific professional areas of
interest will be formed within the division.)

I am willing to work on a Division Committee:

( )   Programming   ( )   Special Interest Sections

( )   Publications   ( )   Awards

( )   Membership   ( )   Other

Complete the above form. Staple your check (made out to CAST Division, AIChE)
to it, fold and mail it to the membership chairman:

R. E. Harris
SOHIO
Midland Bldg. - 206 CB
Cleveland, Ohio 44115