Still trying to catch up, so there will be more News (and less later) in this Newsletter. We find it necessary this month to adhere even more closely to our policy of trying to inform our readers as to who where is doing what about which, rather than giving details of the technical presentations at the various Simulation Council meetings. So when the material covered has been treated — no matter how badly — in this Newsletter previously (as is the case with some of the papers presented at meetings covered this month) or has been published and is available elsewhere (as in the case with most of this month’s papers) we will only give enough information in these columns to help you judge whether you wish to pursue the matter further — and if so, how to start.

With this justificaion, which we fervently hope the aggrieved authors will accept, we give you under Pieces what remains of the following papers which, as originally presented, ranged from worthwhile to excellent:

Jim Fenwick, "On the use of Simulation Techniques in Liquid Rocket Engine Development"

P. R. Dahl, "Simulation Aspects of Nuclear Ramjet Controls"

Richard J. Bohl, "Simulation of Nuclear Rocket Engine Dynamics"

A. C. Robinson, "Measurement of Stochastic Properties Using Analog Equipment"

John Munson, "Optimization by Random Search"

R. J. McGrath, "Adaptive Systems with Random Inputs"

Joe Thie, "Investigation of Random Processes in Reactors"

James Monsma, "Dimensional Tolerance Simulation"

**WESTERN S/C MEETING OF 10 MARCH**

About ninety representatives of thirty-some odd (and some not-so-odd) organizations gathered at North American Aviation-Canoga Park (in California, near Los Angeles) on 10 March:

First on the program was a rather hurried trip through the NAA computing facility. We are indebted to Robert French of NAA for information concerning the Rocketdyne analog installation:

<table>
<thead>
<tr>
<th>Computer</th>
<th>Diode</th>
<th>Electronic Function</th>
<th>Amplifiers</th>
<th>Multipliers</th>
<th>Generators</th>
</tr>
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<tr>
<td>Beckman/Berkley-1032</td>
<td>30</td>
<td>0</td>
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<tr>
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<td>4</td>
<td>0</td>
<td>D/D</td>
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</table>

Additional equipment includes eight servo multipliers. This installation is unusual in the ratio of electronic multipliers to servo multipliers.

There is also an impressive installation of digital equipment which involves a data-processing system called, we don’t know how appropriately, Idiot II. To understand the basic functions of this system see Fig. 1.

Of interest to some of us was a high-speed microwave link between the Canoga Park and Los Angeles computer labs of NAA.

This equipment consists of similar sets of Collins Radio transmitting and receiving equipment, Pacific Telephone and Telegraph modulating and demodulating equipment, and IBM...
The plants are only 25 air miles apart, but because of line-of-sight considerations a relay station on Oat Mountain is used, making the microwave link, which is capable of handling about 120,000 bits per second, about 40 miles long.

There are complete computer facilities at each plant; the microwave link is simply a "tie line" to equalize the load.

After this brief look at the grandeur of NAA computing hardware we hurried to the chartered buses—private cars not allowed (no level space in the mountains)—that took us to the NAA test facilities in the Santa Susana mountains.

Whereas some of us had expected "just" test pits, the installation was complete with offices, cafeteria, and a sizeable and comfortable meeting place where the Western Simulation Council technical session was held.

**Fenwick on Rocket Engine Control**

The first talk, by Jim Fenwick (NAA-Rocketdyne, Canoga Park, Calif.) was based on a paper "Simulation Testing of Rocket Engine Control Components" (an ASME publication, Paper No. 60-AV-24), of which Jim says "additional copies are available and will be mailed on request."

"Twenty-five years ago rocket engines were considered a curiosity with little practical application," the paper states. "Few people knew or cared about rocketry. Today rocketry is represented in this country by a multimillion-dollar industry, vital not only to the immediate safety of our country but also to our prestige as one of the world's greatest powers. It has been pointed out that the rocket industry has three characteristics which put it in a class by itself:

1. A rapidly advancing state-of-the-art in the design of major components.
2. Short runs of low-rate production.
3. Accelerated programs which necessitate concurrent research, development, and production.

These characteristics, and the feeling that we are in international competition, are conducive to the use of promising though unproven concepts and techniques in all phases of this industry. The fruits of many of these new concepts and techniques are sure to be reaped as significant technological advances in many fields other than rocketry.

"One of the most promising new techniques employs analog-computer equipment and appropriate transducers to permit control components to be run closed-loop in a simulated engine environment prior to actual use on an engine. The analog computer and transducers simulate the necessary engine dynamic effects, providing more extensive component checkout than bench tests. This extensive checkout, in turn, greatly improves the probability of component success on the first 'live' engine test.

"The use of simulation suggested in this paper exploits simulation flexibility by utilizing a general-purpose computer as the heart of the simulator and suggests a general-purpose complement of transducers, adaptable to the testing of many varied controls.

"The discussion of rocket-engine control-component testing—by simulation includes a description of a pump-fed liquid-rocket engine, the typical engine-development cycle, the simulation approach, and several cases where it has been used, and a short discussion of typical simulation requirements and the transducer problem.

"To understand the ramifications of simulation testing in the rocket-engine industry, it is necessary first to understand the problems and complexity of the rocket engine itself. A simplified rocket-engine schematic is shown in Fig. 2 with the position of possible control components indicated. This is a pump-fed liquid bipropellant rocket engine, the most versatile rocket engine being made today.

"Two storage tanks under low pressure supply propellant to the turbopumps. The pumps raise the pressure of the propellants so that they can be forced through the thrust-chamber injector at a high rate. Combustion occurs in the thrust chamber, and the resultant hot gases flow through the chamber nozzle and out the bell. Energy is supplied to the turbopump by either burning a small amount of propellant from the main flows (a so-called 'bootstrap' system) or by using auxiliary propellants contained in small pressurized tanks.

"The major components of the engine are:

1. The tanks, thrust mount, and
main propellant ducting;

"2. The turbopump, turbine, and gas generator;

"3. The thrust chamber and injector.

"These are generally large, expensive items and, if anything goes wrong in a test, their replacement represents the expenditure of considerable money and time.

"The control components are usually neither as expensive nor as cumbersome and difficult to replace as are the major components. They are used in starting and stopping the engine, eliminating the effects of missile acceleration, providing minimum burnout weight by emptying the tanks simultaneously, and controlling engine performance by maintaining constant thrust-chamber pressure or turbine power.

"Although each type of engine has its own explosive personality* they are all similar in that they produce extreme power from the continuous combustion of great quantities of naturally unstable propellants under high pressure. In controlling these giants, we cannot trust man's indecisiveness nor can we tolerate his slow reactions. The controls we use must, in every case, be fast and sure. They must be molded around each type of engine individually to obtain maximum performance and to minimize the all-too-apparent hazards.

"The simulator describes the engine environment in as much detail as is deemed necessary for an adequate closed-loop test. The effect of engine start, mainstage, and shutdown operation on the component can be observed under laboratory conditions. If the component operation is not satisfactory the component is redesigned prior to costly engine operation. If the component operates satisfactorily with the simulator, it will have a good chance of successful closed-loop operation with an engine."

This principle holds, even if the component is a human**, "Scott Crossfield, an able and experienced test pilot, found it necessary to fly hundreds of hours in a North American Aviation simulation of the X-15 before going aloft. That simulation was a cockpit, a movie projector, and an analog computer.

"The use of a simulator for component checkout is certainly the most important phase of its operation, since the reduction of hazardous testing represents an obvious saving in money and time. But its use should not be restricted to this operation since, once built, any further use represents only the expenditure of manpower costs, a negligible item."

Simulation should be investigated when any of the following signs is apparent:

"1. A very few expensive complex systems are to be produced.

"2. System performance depends on a critical but complex control component.**

"3. Short schedules necessitate full component development prior to system testing.

"4. Reliability testing is necessary on minor components, but the tests on the full system are hazardous and expensive.

"5. Environmental conditions may be critical to a component, but it is not practical to subject the full system to these conditions."

If such signs, or your natural interest, indicate further study of this matter, we suggest that you write for a copy of the ASME paper and check these references:


**Wish I'd said that!—Ed.

**Though in this case, due to the complexity of changing the design, he is "retrained."

Mr. Dahl did, however, present an erudite treatment of the simulation of nuclear reactor dynamics. So what does your Ed. do? He gives you P. R. Dahl's introduction to Ramjets (because we found it interesting) and deletes his treatment of the simulation of the reactor (because it has been treated, retreated, and retreated again—elsewhere).

So, according to Dahl, Fig. 3 shows the basic elements of a ramjet engine.

"The simple ramjet engine shown is limited to operation in the earth's atmosphere because it relies on inlet air for oxidizer in the case of the chemical ramjet, and for propellant in the case of the nuclear ramjet. Moreover it is limited to operation in a flight regime within which various engine variables are not exceeded. Fig. 4 shows the characteristic limits on a ramjet which define a flight envelope.

Buzz is caused by the engine expelling the normal shock from the inlet. A relaxation oscillation in the engine flow and normal shock positive occurs which will damage the engine structure if buzz persists.

Fuel-to-air ratio, if it exceeds rich or lean limits, will cause engine blowout.

Free stream total temperature increases with Mach number. Structural or reactor core material temperature limits will impose a limit. The engine structure will limit the maximum pressure allowable in the engine. Stagnation pressure and pressure recovery, a function of Mach number and engine design, will define this limit in the flight envelope.
Thermal Stress

The heat exchanger used in a nuclear ramjet relies on large temperature gradients for efficient heat transfer. Temperature gradient, however, is related directly to thermal stress which cannot exceed the strength limitations of the heat exchanger material.

Thrust Characteristics

Engine thrust and vehicle drag are shown in Fig. 5.

"The limiting quantities discussed are indicated on the figure. It is apparent that vehicle flight is limited to the Mach number range within the closed triangular area."

"The quantities indicated must be controlled to insure their being held within defined limits. In most cases only one independent variable at a time is at the control engineer's disposal to hold all of the mentioned dependent variables within their design limits. Thus it is necessary to 'switch,' 'auctioneer,' or 'override' the control system from one input-controlling variable to another."

Superimpose on this all the complexities of reactor control, and you will get an idea of the complexity of the problem solved by Marquardt through Simulation.

Bohl on Rocket Engines

Again, having described the application, we refer you to the author for details. As his complete notes were in reproducible form (ditto), he will probably be glad to send you a copy.

The third talk—by Dick Bohl (Rocketdyne Div., North American Aviation, Canoga Park)—was based on notes prepared for the occasion in order to emphasize the analog-simulation aspect of the study. However, the material was essentially that covered in "Dynamic Analysis of a Nuclear Rocket Engine System" published in the American Rocket Society's Journal for November, 1959.

In his paper a technique for simulation of a nuclear rocket engine system is outlined. The nuclear rocket engine (see Fig. 6) is similar to the chemical rocket engine with one major exception—a nuclear reactor is substituted for the combustion process of the chemical engine. Characteristic differential-equations describing the nuclear engine system dynamics are solved on an electronic differential analyzer.

"Simulation is necessary for the economic design of nuclear rocket engines with adequate, safe and reliable controls," Dick said, and certainly most people will agree. However, we will not report the details of his simulation here because:

1. They're available elsewhere;
2. Even if you have a similar problem the details would differ.

However, you can get a good idea of the nature and scope of the problem treated by looking at the block diagram of the system as shown in Fig. 6.

Following the third and last talk of the technical session, we adjourned for lunch, then all piled into the buses to go witness some test firings. At the first stop the observation station must have been about half a mile from the test stand, which prompted someone to voice a sentiment that I believe most of us felt: "Gosh, is this as close as we can get?"

"Oh, I believe you'll find it close enough," said our guide—and how right he was!

We heard the last few seconds of the countdown and then the fun began! But let my colleague Allan Wilson, who apparently wasn't so awed as ye Ed and Suzy, tell about it:

"In the afternoon, we witnessed two very dramatic test firings. The first was a full-scale (5,000 mile) Atlas engine run. From a distance we watched the last minutes of the countdown and prompt ignition of the Verniers and the three main engines. All engines fired at full power for about three minutes. Boosters then cut out and the other engines fired for another two minutes. It appeared to us that the test was a complete success.

"The second test was a single sustainer engine test viewed at much closer range—about 700 feet. It was mounted horizontally, with the business end pointed almost directly toward us. As the noise level was close to the threshold of pain, and as thermal radiation was distinctly noticeable, it was apparent that closer observation would have required protective gear.***

"Shock diamonds were evident in the flame, and as the fuel-to-LOX ratio was changed we saw—and felt in our stomachs—a definite change in the flame pattern."

"I left the test firings with a distinct increase in respect for the Mercury Astronauts who will have the courage to sit on top of that raging inferno and blast off into space!"

A very unusual Simulation Council meeting!

*i.e., nearly knocked flat!*

**Which side?**

***Your Ed would have preferred a fallout shelter to fall out in!
The first talk was "Measurement of Stochastic Properties Using Analog Computing Equipment" by A. C. Robinson (Wright Air Development Center, Dayton, Ohio). The following are Robie's notes. After you've read them and studied Figs. 7 and 8 you will know as much (or probably more) about his presentation as we do.

**THEOREM 1. Determination of Mean Value**

Let \( x(t) \) be a stationary, ergodic random process of mean \( M \). Let \( y(t) \) be another random process defined by \( y(t) = x(t) - M \). If \( y(t) \) has a continuous power spectrum (no periodic components) then a consistent and convergent estimate of \( M \) is given by

\[
M_T = \frac{1}{T} \int_0^T x(t) \, dt \quad (1)
\]

Furthermore, the ratio of the variance of the estimate to the variance of \( y(t) \) is given by

\[
\frac{\sigma_x^2}{\sigma_y^2} = \frac{2}{T} \int_0^T (1 - \tau) \rho_y(\tau) \, d\tau \quad (2)
\]

where \( \sigma_x^2 \) is the variance of the estimate, \( \sigma_y^2 \) is the variance in \( y(t) \), and \( \rho_y(\tau) \) is the normalized autocorrelation function of \( y(t) \). Also, the limit of the integral of (2) exists as \( T \) becomes infinite.

**THEOREM 2. Determination of the Autocorrelation**

Consider a random process \( x(t) \) which satisfies all the conditions of Theorem 1, and in addition is Gaussian. Then a convergent and consistent estimate of the autocorrelation of \( x(t) \) is given by

\[
\Phi_T(\tau) = \frac{1}{T} \int_0^T x(t) x(t+\tau) \, dt \quad (3)
\]

and the variance of this estimate obeys the relation

\[
s^2 \leq \frac{4}{\pi} \int_0^\infty \Phi_T(\tau) \, d\tau + \frac{8M^2}{\pi} \int_0^\infty \Phi_T(\tau) \, d\tau
\]

where \( \Phi_T(\tau) \) is the autocorrelation of \( y(t) \).

Anyway, it's an interesting and important technique. If you've used for it we are sure a letter to Robie will get you the necessary details.

**Munson and Rubin on Random Search Optimization**

The second talk on the program was based on a paper "Optimization by Random Search on the Analog Computer" by John K. Munson (Engineering Services Div., DuPont, Wilmington, Del.) and Arthur Rubin (Electronic Associates, Inc., Princeton, N.J.), which was originally given at the National Simulation Conference in Dallas in October of 1958.

"Recent years," the paper points out, "have seen increased emphasis on optimum design and operation and military weapons systems, physical and chemical processing systems, and business systems. In general such systems can be designed and operated under many different sets of conditions. It is the purpose of an optimization study to determine the best combination of such conditions within restraints imposed by economy, physical size, and other limitations of a system or surroundings."

"An investigation of a typical system includes the following steps:

a. Describe system operation by a set of equations obtained theoretically or through study of an existing pilot unit.

b. Specify restraints on the variable system parameters.

c. Express the characteristics to be optimized as a function of all significant system variables and define the 'optimum' value.

d. Devise a method of choosing combinations of system parameters for evaluation which will allow selection of optimum conditions in an economical manner."

"For example, consider a chemical reactor which will operate under many combinations of temperature, pressure, catalyst activity, and reactant concentrations. Optimum design and operation of this reactor is defined as that combination of conditions which will supply the available market demand at the lowest operating cost. In order to find the optimum it is necessary to have available a model reactor or its mathematical equivalent. Restrictions on the variables must be specified. For example, the maximum pressure allowed at any given temperature due to strength of materials or capabilities of auxiliary equipment such as pumps and blowers. An equation describing the operating cost as a function of the system variables must be written. A method of experimentation is necessary which will locate the area of optimum operation with an economical expenditure of time and effort."

"The traditional role of the analog computer in optimization studies has been to act as an electronic mechanization of a mathematical model of the system to be investigated. Design parameters and operating conditions can be easily changed and system operation determined quickly, economically, and safely. The model is run under many sets of operating conditions. The results of such a set of experiments can be analyzed by statistical regression techniques in order to point out the area of optimum operation. Also, linear programming techniques have been applied, where appropriate."

The paper describes an application of the analog computer which decreases the amount of statistical analysis and auxiliary calculation required. The high speed of the computer is utilized to evaluate many more combinations of operating variables than would otherwise be economically feasible.

The Random Search Method; Typical Circuitry, including random noise generators, comparison and storage circuits, and restraint limiters; applications and conclusions are considered in the paper, which is such an excellent treatment of so important a subject that if it hadn't already been published we would have tried to give it to you verbatim in the Newsletter. Under the circumstances we recommend that those interested in the technique request copies from the author and/or check these references:

*Mr. A. C. Robinson, Attn: WCLJY, Wright Air Development Center, Wright-Patterson Air Force Base, Ohio.

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McGrath on Adaptive Systems

The third talk was "Adaptive Systems with Random Inputs" by R. J. McGrath (University of Wisconsin). We have nothing on this presentation but the author's own summary, as follows:

"Some of the problems which result when adaptive systems are subjected to random inputs were discussed. A system was described which used continuous parameter disturbance and correlation detection of the disturbing signal in some error measure. This result was fed into a parameter controller and adjusted so that parameter to minimize the error measure. The parameter misadjustment could be caused by either an input process change or system parameter changes. Experimental results were shown for a simulation which adjusted two parameters simultaneously."

Dick writes that he and Professor Rideout are preparing a paper for the IRE-PGAC on the subject.

Thie on Reactor Noise Analysis

The fourth talk was based on a paper, "Statistical Analysis of Power-Reactor Noise" by J. A. Thie (Argonne National Laboratory, Lemont, Illinois) which was published in Nucleonics in October 1959 and describes an interesting technique for getting some use out of noise.

"The rate of fission in a reactor operating at a certain power level does not remain perfectly constant with time," states the author, "but fluctuates in a random way about an average value. This reactor "noise," because it stems from statistical fluctuations in reactivity inherent in the system (such as turbulent flow of the coolant), is present as an unavoidable condition in all reactors. However, there is a way to put reactor noise to some use—a frequency-spectrum analysis of the noise can provide, essentially "free-of-charge," some interesting information about reactor kinetic performance."

"Fourier transform methods already used to analyze the radar signals, light from twinkling stars, etc. permit one to determine the distribution of frequency components present in reactor power fluctuations.

Once we have this frequency distribution, we can extract from it various kinds of information:

- A recording of reactor flux fluctuations is all the experimental information needed to detect sharp resonances in reactor transfer functions. (For precise measurement of broad resonances, a knowledge of the approximate shape of the noise spectrum driving the reactor is helpful.)
- In zero-power reactors noise analysis will give the neutron lifetime (1).
- For other reactors the coefficients in the differential equations governing dynamic behavior can be obtained (2, 3).
- A power spectrum derived from noise analysis together with a measured or calculated transfer function will yield information about the basic causes of reactor noise.
- Continual monitoring of reactor noise could provide an additional safety check for the reactor operator. For instance, an analog computer might continuously analyze the fluctuations (see Fig.) and display the instantaneous power spectrum to the operator, who could check it for the appearance of resonances."

Power fluctuations, autocorrelation, analog simulation, power-spectrum analysis, and reactor stability are all treated in some detail in the Nucleonics article.

Monsma on Dimensional Tolerances

The fifth and last paper on the program was interesting and, for a Simulation Council meeting, unusual. It was interesting because of the importance of the subject treated, and unusual because it describes the use of a digital computer for simulation.

The title of this excellent paper is "Dimensional Tolerance Simulation" by James E. Monsma (Applied Science Representative, IBM, Peoria, Ill.)

"Simulation does not make the strong claim in digital computing that it does in analog work," the author begins. "Much digital work is done in the area of data processing for business accounting and management. Even digital computing which is of a scientific or engineering nature is viewed as formula evaluation or number manipulation, rather than as a simulation of some physical situation.

"On the other hand, simulation is not new in digital computing. Some of the first applications were simulations in the field of nuclear physics. Recently there has been a renewed interest in simulation, and it is fast becoming a most important digital computing technique. Two of the most interesting and important recent simulations are:

"The Business Game—Simulation of an economic atmosphere. This technique offers the fields of business and economics their first real laboratory.

"Job Shop Simulation—This technique offers management a tool for better understanding of its business."

"One interesting fact about digital computer simulations is that almost without exception they employ random number techniques; even those which are basically deterministic in nature. Both types of simulation have stochastic elements. In business games sales are generally a random variable. In the job-shop simulator orders may be released to the shop randomly. The simulation I am going to talk about today, however, is stochastic by its very nature. It is a dimension tolerance simulator and lies on the border line between engineering design and manufacturing. I refer to it as the 'Tolerance Problem', since this is the way it was first brought to my attention a few years ago."

"The basic problem, I think, must be laid at the feet of manufacturing. By the very nature of the manufacturing process no two parts come out exactly alike. There are always slight variations."

"Since these variations can cause some problems in assembly, the manufacturer has persuaded the design engineer to prescribe tolerances to the dimension of the parts. If all parts are within tolerance, the assembly is expected to perform as required. So most design engineers have prescribed tolerances in such a
way that even if all the parts were all the way to the limits of their tolerances, the assembly would still work.
For years this has been an acceptable method of operation. It is often called the ‘worst case’ method of calculating tolerances.

“As the science of Quality Control came into being and people began to realize the statistical nature of these manufacturing variables, this method of tolerancing become intolerable!* Several methods have been formulated to interpret the idea of statistical distributions into the process of assigning tolerances, none however as general as the method of simulating the assembly by means of a digital computer. The technique discussed here was worked out on the IBM 650. Later I discovered that a similar technique is employed in the design of circuits at our Rough-keepsville plant using the IBM 704.

“Each part of an assembly will have one or more dimensions. These component dimensions take on specific values according to statistical distributions resulting from the manufacturing process. The relationship of these distributions to the tolerances on the engineering drawing and the given dimensions is frequently coincidental(!) These component dimensions are combined in some way in the assembly, and the resultant values of these critical dimensions determine whether the assembly is acceptable or not.

“There are three important points:
1. The distribution of the values of the component dimensions.
2. The relationship between the component and the critical dimensions. This is a mathematical formula for each critical dimension.
3. The limits for the critical dimensions. Beyond these points the assembly is no longer considered ‘good’. Some time the distributions of these critical dimensions may be the interesting thing.”

In our copy of the paper, which we are sorry to see is typed rather than produced from a master, the author describes and illustrates (with Kodacolor prints, apparently of slide projections) the computer program, first in general “to get some perspective,” then in some detail.

Certainly such important work will be published in toto somewhere. And even though we can’t fit all the details into the Newsletter, perhaps a note to the author will get you the complete word.

*When is tolerance intolerable? Sounds like the segregation issue in you-know-where!

Information (Without Theory)

A letter from our long-time acquaintance John Lowe informs us that the rather extensive REAC-400 installation at Douglas-Santa Monica is available on a rental basis.

DeHaas Company has announced that Carlton Peterson has joined the company as a sales engineer. Mr. Peterson was president of his own company, Steven-Douglas of Santa Monica, which engaged in research and development contracts in the electro-mechanical and electronics areas for seven years, but he might better be remembered for his 120' yacht and some of the parties thereon.

We have a three-language invitation to AICA—the Third International Conference on Analog Computation in Belgrade, September 4-9, 1961, but are afraid we can’t make it. Perhaps the fourth one?

We have a letter from Dick Bohl (Rocketdyne, Canoga Park, Calif.) in which he says, “I would appreciate it very much if you could stimulate interest in the Y's Simulator among analog computer manufacturers.” We admit we are confused (some people are very easily confused), but we believe he is referring to the section of his paper (described under Pieces) on iron-core coil response.

Letters

“Dear John:

“I am back from a short vacation which I spent mostly washing the multitude of windows in our cottage and thinking about a new graduate course which I will be starting in September: Information and Control (Cybernetics).

“Our Hall Effect effort has produced, on the practical side, a transistorized analog multiplier with attractive characteristics and considerable simplicity. My ‘publication schedule’ is completely messed. I have not yet finalized even last year’s report on the Hall Multiplier project. So it will take probably another year before the next (and more interesting) report will be ready. . . . . .

“It just occurred to me that you may not be aware of one ‘Control’ development in Canada. Our National Research Council has established an ‘Associate Committee on Feedback Control’; I am one of its members. All other famous names are also there (Arthur Porter, Jim Ham, d’Ombra, etc.). We have already had two lengthy meetings and plenty of verbal output. The purpose of the Committee is to coordinate control activities in Canada and on the international level. If anything useful should develop I will let you know.

G. S. Glinski, Chairman
Electrical Engineering Department
University of Ottawa
Ottawa 2, Canada”

“Dear Mr. McLeod:

“I am sending you a summary of the Seminar on Analogue Methods in Nuclear Energy Problems. This will appear in Vol. 2, 3 of the Proc. of the International Association for Analog Computation. This may be of sufficient interest to you to mention this in your Newsletter.

Yours sincerely,
For Electronic Associates Inc.
R. Compert,
Manager Special Projects
European Division”

As members of the IAAC we receive their publications and find their international point of view very interesting. Those interested may join by sending a check for 250 Belgian francs to Association Internationale pour le Calcul Analytique, 50, Avenue Franklin Roosevelt, Bruxelles 5, Belgium. Ed.