Know What an OFT is?

Ever since your Ed has been responsible for this Newsletter (10 years last November), he has from time to time been reminded that Operational Flight Trainers (OFTs) are Simulators, and that their design, development, sales, and use comprise a very important area in the field of simulation which we have almost completely ignored.

I always agreed that this was muy malo but, being preoccupied with making a living, raising a family, editing a Newsletter, playing, etc., I never got around to actively wooing this important group of practitioners of the art of make-believe.

Now it looks as though, if I don’t get busy and propose, there will be a shotgun wedding—and this is the “cause why”

The Simulation Councils profess an interest in all kinds of simulation.*

In fact our Articles of Incorporation commit us to serving such interests. But we got our original impetus largely in the aircraft (now aerospace!) industry, simulating automatic systems which were designed either to eliminate the requirement for a man in the system, or to take over certain of the man’s responsibilities. Man was, in general, de-emphasized.

*As we define it—but I’m saving that pertinent point for discussion in a future issue.—Your Ed.

Contrasted to this were the interests of the OFT people, where the man-in-the-loop was of primary concern. All of their activities were directed toward creating an environment suitable for training a man to perform specialized and exacting tasks with proficiency.

The difference in emphasis was sufficient to characterize the activities of the two groups and somehow, though we have always had much in common, we went pretty much our own ways.

But as man enters space so must he also enter space system simulations—and the interests of the OFT simulation people and the simulation people of the aerospace industry become indistinguishable, one from the other.

So ye Ed, with the encouragement of the SCI Board of Directors, “proposes” to give better coverage to the activities of the OFT simulation people. We beg their hand, not exactly in matrimony, but in an effort to get the material necessary to give that better coverage. We invite their participation in our meetings and symposia, and we solicit technical material which might be published, abstracted, or discussed in these columns.

We also solicit comments on this article!

SOUTHEASTERN SIMULATION COUNCIL MEETING OF 20 JULY 1962 ON PLUG-FLOW SYSTEMS, LIQUID-VAPOR HUMIDIFICATION COMMAND COMMUTATION AND AEROSPACE VEHICLES

Concerning the featured meeting this month, Mrs. Janie Owen, the Secretary’s Secretary, writes for James L. Williams in part as follows: “A most enjoyable meeting of the Southeastern Simulation Council was held on July 20, 1962 with the George C. Marshall Space Flight Center, Huntsville, Alabama as hosts. There were 36 attendees for the program and four papers were given.

“I have enclosed only three of these papers; however, I hope to forward the fourth to you before publication deadline.” This (fourth) paper is entitled “Analog Computation Applications in the Non-Linear Analysis of a D Din’t make it—Ed.”
Multiple variable problems like the ones bothering our friend involve generating a great many independent trial solutions. The combination of GPS high-speed operation, with memory capability, logic-controlled iteration and time-sharing of computer units gives most reliable results. Operating on a compressed timescale of 3000 to 1, the GPS Computer System performs in one-tenth of a second a problem which in real time computation would require five minutes. A wide variety of problems, new to the analog computing art, can now be solved by the GPS Multiple Timescale Analog Computer with speeds and dynamic accuracy unmatched by any other analog computing system available today. Write for Technical Information.
Simulation of Liquid-Vapor Humidification

G. T. FISHER
Vanderbilt University

\begin{figure}
\centering
\includegraphics[width=0.5\textwidth]{fig1}
\caption{Counter-current liquid-vapor heat exchanger.}
\end{figure}

Notation

\begin{align*}
c_l & = \text{heat capacity of liquid phase, Btu/lb\textdegree F} \\
c_v & = \text{vapor heat capacity of gas phase, Btu/lb\textdegree F} \\
G_d & = \text{dry gas flow rate, lbs dry air/hr} \\
G_l & = \text{liquid flow rate, lbs water/hr} \\
h_{l,a} & = \text{liquid phase heat transfer coefficient, Btu/hr-ft\textdegree F} \\
h_{v,a} & = \text{gas phase heat transfer coefficient, Btu/hr-ft\textdegree F} \\
k_{oa} & = \text{mass transfer coefficient, lbs air/hr-ft\textdegree} \\
N_A & = \text{mass transfer rate, lbs water/hr-ft\textdegree} \\
q_{v,0} & = \text{sensible heat transfer rate in gas phase, Btu/hr-ft\textdegree} \\
q_{l,0} & = \text{sensible heat transfer rate in liquid phase, Btu/hr-ft\textdegree} \\
q_v & = \text{latent heat transfer rate in gas phase, Btu/hr-ft\textdegree} \\
t_0 & = \text{gas temperature, \textdegree F} \\
t_i & = \text{interface temperature, \textdegree F} \\
t_l & = \text{liquid temperature, \textdegree F} \\
V & = \text{volume of tower, ft\textdegree} \\
Y & = \text{humidity, lbs water/lb dry air} \\
Y_i & = \text{humidity at the interface, lbs water/lb air} \\
\lambda & = \text{heat of vaporization of water at t_i, Btu/lb}
\end{align*}

In many processes a gas is humidified in contact with a countercurrent liquid stream, and heat is transferred between the two phases. For example, the cooling of water for re-use is frequently effected by contact with air in spray ponds, spray towers, slatted cooling towers, or other contacting devices. Air-conditioning systems require humidification of the air stream for humidity control. Various chemical processes require humidification of an air stream by a chemical—for instance, methanol is vaporized into an air stream and then a gas-phase oxidation converts it to formaldehyde, paraxylene is oxidized by contacting with air and with a consequent vaporization of paraxylene into the air stream.

In this paper, the rate processes of the simultaneous heat and mass transfer are formulated, and an analog-computer program is presented for the solution of the resulting equations. Typical results for three different operations of the air-water system are presented.

The Physical Problem

Air and water will be used as the vapor-liquid system in this discussion. Fig. 1 shows a countercurrent contacting device. Air is introduced at the bottom, and water is added at the top of the contactor.

The differential equations of the system arise from material and energy balances on a differential section. Two assumptions will be used: (1) the sensible heat of the water vaporized is small in comparison to the latent heat, and can be neglected; (2) the quantity of water vaporized is small in comparison to the total quantity of liquid water throughput of the system, and thus the water flow rate can be considered constant. The rate of (1) sensible heat transfer in the liquid phase is

\begin{equation}
q_{l,0} = h_{l,a} (t_l - t_i)
\end{equation}

(2) sensible heat transfer in the vapor phase is

\begin{equation}
q_{v,0} = h_{v,a} (t_l - t_i)
\end{equation}

(3) mass transfer to the vapor phase is

\begin{equation}
N_A = k_{oa} (Y_i - Y)
\end{equation}
A SIMPLIFIED GUIDE TO COMPUTER CONTROL AND DATA PROCESSING

Plug these solid-state computing modules into an EAI PC-12 chassis, patch them together to suit your application and you have a uniquely versatile computer—today's answer to the demand for simplified, reliable and low-cost computer control or data processing. Assembled from standard, off-the-shelf transistorized modules, the computer is low cost, flexible in programming and can never become obsolete. The computer accepts directly the outputs of thermocouples, strain gauges, resistance thermometers and other electrical primary elements without the need for costly conversion equipment. □ Auxiliary equipment for the EAI PC-12 computer includes plug-in overload indicators, logic modules, automatic calibrators, thermocouple cold junction references and reference regulators for strain gauge, thermistor or resistance thermometer excitation. Both industrial and rack-mounted housings are available. □ EAI Computation Centers are equipped to help you specify your computer application requirements. Your problem type may already be in our files. □ Write for Bulletin AS 6201 for full details on this new approach to computer control.
(4) latent heat transfer to the vapor phase is
\[ q_v = \lambda k \Delta a (Y_1 - Y) \] (4)
The energy balance on (a) the liquid phase is
\[ q_l = G_c \frac{dY}{dV} \] (5)
(b) the vapor phase is
\[ q_v = G_a \frac{dY}{dV} \] (6)
(c) the interface is
\[ q_a = q_l + q_v \] (7)
The material balance on the gas phase is
\[ N_a = G_a \frac{dY}{dV} \] (8)

The equations for solution are, by eliminating \( q_l, q_v, q_a, \) and \( N_a, \)
\[ \frac{dY}{dV} = \frac{k \Delta a}{G_c} (Y_1 - Y) \] (9)
\[ \frac{d\Delta a}{dV} = \frac{h \Delta a}{G_a c} (t_l - t_a) \] (10)
\[ \frac{d\Delta t_v}{dV} = \frac{h \Delta a}{G_a c} (t_v - t_0) \] (11)
\[ h \Delta a (t_l - t_1) = h \Delta a (t_v - t_0) + \lambda k \Delta a (Y_1 - Y) \] (12)

Equilibrium at the interface is postulated; that is, the temperature of the phases on each side of the interface is the same, and the vapor phase is saturated immediately adjacent to the interface. These are the assumptions of the conventional two-film theory. The equilibrium relation, that is, the 100% saturation relation, can be expressed functionally as
\[ t_l = t_1 (Y_1) \] (13)

Equations 9 through 13 constitute the system for solution. The relationship of the variables is schematically illustrated for a point in the tower in Figure 2.

The analog computer solution of the five equations is shown in Figure 3. The program requires 19 amplifiers, 2 servomultipliers, 1 potentiometer, and 13 coefficient potentiometers. The circuit was programmed so that each coefficient appears only once, except for \( G_a \) (the gas flow rate) which appears twice.

**Some Solutions**

The equations were solved for 3 different sets of conditions at the bottom of the tower. The temperature-humidity profiles are presented in Figures 4, 5, and 6.

Fig. 4 is a solution for an actual operation of a contact tower. The conditions at the bottom of the tower were:
- \( G_a = 241 \) lb dry air/hr
- \( G_v = 240 \) lb \( H_2O \)/hr
- \( t_l = 104.5^\circ F \)
- \( t_g = 83^\circ F \)
- \( Y = 0.011 \) lb \( H_2O \)/lb dry air

\[ \frac{h \Delta a}{1000 (t_l - t_1)} \]
Offner Type S Ink-Rectilinear Dynograph° locks in accuracy at pen point with servo control

Pen points are servo controlled by input signal—positively constrained to a single straight line • pressure ink system assures maximum legibility—minimum maintenance • transistor circuitry for instant warm-up, low power consumption • gives all advantages of other offner recorders plus ink-rectilinear tracings • for complete data see your offner representative, or write us.

Specifications

Number of channels:
1—8 standard; to 24 special

Event marker:
One or more available

Sensitivity:
With preamp 1 µV/mm to 5v/mm
Without preamp 1 mv/mm to 5v/mm

Frequency response:
DC to 150 cps

Phase error:
0—100 cps < 0.1 msec delay error
0—150 cps < 0.7 msec delay error

Response time:
2.5 msec at 5 mm deflection
4.0 msec at 10 mm deflection

Noise:
With preamp < 0.5 µV, RMS
Without preamp invisible

Hysteresis:
0.1% (full scale) locked in by positional feedback

Resolution:
0.1% (full scale) locked in by positional feedback

Linearity:
0.15% (full scale) for DC; or AC with maximum amplitude envelope

Drift:
With preamp 1 µV/hr at max. gain
Without preamp < 0.05 mm/hr (shorted input)

Recording amplitude:
Full chart channel width from DC — 30 cps with progressive reduction to 5 mm at 150 cps

Input:
With preamp...differential
Without preamp...single-ended

Input impedance:
With preamp 2 megohms
Without preamp 1 megohm

Zero suppression:
With preamp 50 cm
Without preamp 15 cm

Calibration:
Internal

Paper speeds:
9 push button selected, standard speeds 0.1, 0.2, 0.5, 1, 2.5, 5, 10, 25 cm/sec. Other speeds on special order

Paper speed accuracy:
1.0%

Ambient temperature range:
-20°C to +80°C

Input couplers:
All types available

Power requirements:
80 w. average; 140 w. max (8 channels)

Warm-up time:
Instantaneous

Auxiliary power available:
+15v, 0.5 amps DC
-15v, 0.5 amps DC
6v, 10 watts, 400 cps

High-in, high-out switch:
For recording DC or low frequency signals. Signal frequencies above 50 cps (approx.) attenuated in "High-Out" position

Nominal cost/channel:
With preamp $1,250
Without preamp $850
These are indicated by the triangles in Fig. 4. The experimental conditions at the top of the tower were:

\[ t_l = 123.6^\circ F \]
\[ t_0 = 90.0^\circ F \]
\[ y = 0.026 \text{ lb H}_2\text{O/lb dry air} \]

These are indicated by the squares in Fig. 4. The mass and heat transfer coefficients for the operation were determined by the trial and error graphical procedure of Mickley, and these graphically determined values were, for a total tower volume of 1.05 ft$^3$,

\[ h_{u,a} = 210 \text{ Btu/hr-ft}^2{^\circ }F \]
\[ h_{o,a} = 59.0 \text{ Btu/hr-ft}^2{^\circ }F \]
\[ k_{a} = 244 \text{ lbs air/hr-ft}^3 \]

The curves in Fig. 4 were constructed using these values of the coefficients. The agreement is remarkable between the conditions at the top of the tower experimentally measured and those predicted by the analog program using the coefficients from the Mickley method.

The experimental conditions indicate a heat loss from the tower of 7% of the total quantity of heat transferred, and this error could account for some of the discrepancy. Thus, Fig. 4 indicates the utility of obtaining unknown coefficients from experimental data by a trial-and-error fit. High-speed repetitive operation cannot be used unless the servos are eliminated. It should be added that the Mickley graphical method is valid only for the air-water system; hence, this program would be extremely useful for other systems.

Fig. 5 shows a solution generated by using the same values at the bottom of the column as used in the solution shown in Fig. 4, except the entering air temperature, \( t_0 \), was changed from 83\(^\circ\) F to 100\(^\circ\) F. This solution illustrates the cooling of both the air stream and the water stream in the tower. This situation arises when dry air is contacted with water, and the rate of vaporization is so large that it requires sensible heat from both the air and the water stream.

Fig. 6 is similar situation, except the water is being cooled to a temperature below that of the air. The entering air temperature, \( t_0 \), was set at 100\(^\circ\) F, and the exit water temperature at 95\(^\circ\) F.

The curves reproduced in Figs. 4, 5, and 6 are direct reproductions of the curves drawn by the x-y plotter of the computer. The 100% saturation line is shown in each figure.
Conclusions

The analog computer program presented is satisfactory for obtaining unknown mass and heat-transfer coefficients from experimental data, or in predicting performance from known rate coefficients.

References


Acknowledgements

The author would like to thank the Chemical Engineering Department, University of Tennessee, for use of the Pace 221-R computer, and Union Carbide Nuclear Company, Oak Ridge, Tennessee, for assistance in preparation of the manuscript.

Appendix

Scaling

The equations were scaled by the transformations

\[ \tilde{t}_L = t_L - 60 \]
\[ t_G = t_G - 60 \]
\[ \tilde{t}_I = t_I - 60 \]
\[ V = 25\text{V} \]

This allowed the solution to be run in 25 seconds.

Minimum Equipment Requirement

By sacrificing some of the flexibility of operation, amplifiers 2, 3, 7, 9, 11, 13, and 14 may be removed without changing the program. Amplifier 4 may be removed by generating \( -\tilde{t}_I \) rather than \( \tilde{t}_I \) in the padded potentiometer. Amplifier 18 and servo multiplier No. 1 may be removed by programming the humid heat capacity as a constant; the variation in \( c_H \) is frequently less than 5%. Amplifier 10 serves only as a time-base generator. Thus the minimum equipment requirements for solution are 9 amplifiers, 1 servo-multiplier with padded potentiometer, and 9 coefficient potentiometers.

The Complete Equations of the System

If the sensible heat effects and the variation of liquid phase flow rate are taken into account, the equations become "rigorous"; thus, only the assumptions of the two film transfer mechanisms are involved. The complete equations are

\[ \frac{d\tilde{t}_L}{dV} = \left[ \frac{h_{L,R}}{c_{L,R}} - \frac{G_L}{G_L} \frac{dY}{dV} \right] (t_L - t_I) \]  
(14)

\[ \frac{d\tilde{t}_G}{dV} = \left[ \frac{h_{G,R}}{c_{G,R}} + \frac{c_{p,H_2O \text{ vapor}}}{c_s} \frac{dY}{dV} \right] (t_I - t_o) \]  
(15)

\[ \frac{dY}{dV} = \frac{k_{oa}}{G_o} (Y_I - Y) \]  
(16)

\[ h_{oa} (t_G - t_I) = h_{oa} (t_I - t_o) + \lambda_I k_{oa} (Y_I - Y) \]  
(17)

\[ t_I = t_I (Y_I) \]  
(18)

The fourth paper on the program, "Commation of Control Surface Commands in Rolling Missiles" by Maynard Sikes (Senior Engineer, Martin-Marietta Corporation, Marietta, Georgia) will not be reproduced in full because, although interesting, it describes a special application. It is concerned with the development of a logical network of and/or gates to replace a mechanical commutator used in the simulation of a rolling missile.

If the following excerpts from the author's paper stimulate an interest in further details, they can undoubtedly be obtained by contacting the author directly.

COMMUTATION OF CONTROL SURFACE COMMANDS IN ROLLING MISSILES

Whenever a missile is to be guided along a LOS or some other predetermined path to a target, either manually by a pilot or automatically, some method is necessary for insuring that the earth-oriented commands (up, down, right, left) are properly applied to the control surfaces. One way of doing this, and probably the most obvious one, is by automatically roll stabilizing the missile. This, however, requires a fairly elaborate control system and is not always economically practical in small, inexpensive missiles.

The alternative method is to allow the missile to roll (or force it to do so) and keep track of the roll angle by means of a gyro in the missile. The commands are then routed to the appropriate control surfaces by a commutator which derives its roll reference from the gyro. This commutator usually can be an inexpensive mechanical device because close manufacturing tolerances are not required.

In the simulation of rolling missiles at Martin-Orlando, some method of including the effects of the commutator in the control loop was desired, since the presence of the commutator can have a significant effect on the time response of the system. The method first used was to take an actual missile commutator and couple it mechanically to the shaft of a servo rate resolver. The angular roll rate of the missile then was either calculated as a degree of freedom in the simulation, or programmed as a function of Mach Number and fed into the rate resolver.

Although the mechanical resolver-commutator combination was adequate, it was cumbersome and somewhat unreliable. Primarily because the commutator was designed for short-lifetime operation. In addition, the threshold and dynamic response of the servo resolver limited the accuracy of the simulation. The acquisition of four new PACE electronic resolvers capable of continuous rotation provided the means to an all-electronic simulation, with the exception of the commutator.

Before undertaking the building of an electronic device to replace the commutator, it was necessary to analyze in some detail the operation of the mechanical commutator. If its operation could be formulated in logical form, it should be simple to implement it.

(If you want the details you will have to get them from the author, but we are pleased to give you his closing lines—Ed.)

The commutator has been in use
The Analog Computer that
Beckman ease\textsuperscript{®} Analog Computers do lots of things—
should you want. You could simulate heart action, systemic circulation, and pulmonary circulation. Beckman successfully did this recently with an ease Computer to study the ventricular pump action of the heart. In the computer, blood pressure was analogous to voltage, blood flow to current, blood volume to charge. The ease 2100 Computer with its iterative capability was the key—reproducing the cyclic behavior of circulation. □ You never know what your own analog computer might become – today a "heart," tomorrow a "space vehicle." That's why the versatility of Beckman analog computers is so important. And—what about your future needs? When the time comes, you can economically change from non-iterative to iterative operation, manual to automatic programming, and expand your non-linear capability just by adding modules. □ Maybe you want the full printed report of this heart analog—or more information on advanced Beckman analog computers. Drop us a line.
Backed by 15 years' proof of RELIABILITY

REAC® 500 ANALOG COMPUTER

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REAC 500 is the proud successor to a long line of REAC Analog Computers first produced more than 15 years ago. Most REAC installations are still in operation — many "round-the-clock" — with unscheduled down-time averaging less than 3%.

The same high quality built into our previous models has been maintained in the new REAC 500 series which are now in production. REAC is synonymous with RELIABILITY — safeguarded by our uncompromising standards for performance, construction, and ease of maintenance.

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Qualified engineers who are seeking rewarding opportunities for their talents in this and related fields are invited to get in touch with us.
for about four months and has given excellent service with no down-time or maintenance required. It replaces its mechanical counterpart directly. The logic circuitry is fast enough by analog standards to even run rep-op if desired. (In pilot controlled systems, however, we have had some difficulty in locating a rep-op pilot.)

**Analog Techniques**

**A MULTI-COMPARATOR CIRCUIT**

G. A. KORN, University of Arizona

The multi-comparator is a device which can be used to perform multiple decisions or in analog-to-digital conversion. Essentially it is a function generator which can produce jump discontinuities in its output at pre-selected points.

Fig. 1 shows the basic circuit for the multi-comparator. The diode function generator is set up with the function shown in Fig. 2. On the portions of the function where the slope is negative the high-gain amplifier has regenerative feedback, which causes the transfer characteristic to exhibit a comparator-type response. This regenerative action minimizes the effects of temperature and diode characteristics.

By carefully setting the function generator, the width of the hysteresis effect can be reduced to a magnitude such that its effect is negligible unless this effect is desired. On the portions of the $x_0$, $x_1$ curve with finite slope, the slope is the negative reciprocal of the positive slope in the corresponding segment of the $y$ vs $x_0$ curve.

Fig. 4 illustrates a practical circuit. Note that the output terminals marked $V_1$, $V_2$, $V_3$, and $V_4$ yield positive comparator steps starting at zero, which is particularly useful for operation of associated digital circuitry. Addition of extra diode channels yields up to 13 comparator steps (16 = $2^4$ states); $2^n$ diodes yield $(n+1)$ states and only two amplifiers are used. In the case shown, unity slopes and equal break-point intervals are shown for convenience, but these features may be altered to suit the particular application.

The multi-comparator circuit works up to 20 cps with Philbrick K2-XA amplifiers and short wiring; for operation at low frequencies the circuit can be patched with ordinary computer amplifiers and diode function generators.
TURN IN THE BOTTLES

You're now computing with vacuum tube amplifiers—but you'd go solid state if you could.
You can with Donner's all solid state, full power, full range, up to ±100 v operational amplifier.
It's the only transistorized amplifier that matches vacuum tube performance in voltage range, power gain, and signal to noise ratio (see specs below).
Featuring a unique electronic solid state chopper, Donner's ±100 volt amplifier is compatible with all standard electronic instruments and interchangeable with any vacuum tube amplifier.
Like all Donner solid state amplifiers, the 3821 can be supplied with circuit modifications and packaging variations to satisfy your system.
You can evaluate any Donner amplifier yourself simply by contacting our representative or dropping us a line. We carry all standard models in stock so there'll be no delay.

SPECIFICATIONS, MODEL 3821 OPERATIONAL AMPLIFIER

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output</td>
<td>±100 v at 20 ma</td>
</tr>
<tr>
<td></td>
<td>±60 v at 40 ma</td>
</tr>
<tr>
<td>Open-loop Gain (at dc)</td>
<td>5 x 10^6 typical</td>
</tr>
<tr>
<td></td>
<td>2 x 10^6 minimum</td>
</tr>
<tr>
<td>Drift (referred to input)</td>
<td>a. constant temp.: 100 µV/8 hrs.</td>
</tr>
<tr>
<td></td>
<td>b. -20°C to +45°C: 150 µV/10°C.</td>
</tr>
<tr>
<td></td>
<td>c. -55°C to +55°C: 200 µV/10°C.</td>
</tr>
<tr>
<td>Input Current</td>
<td>10^{-10} amp</td>
</tr>
</tbody>
</table>

*Donner offers three basic amplifiers: ±20 v range silicon; ±20 v germanium; and ±100 v germanium, all electronic chopper stabilized.
UNIVERSITY OF ARIZONA Systems Engineering, Department, with some aid from National Science Foundation, has installed this $2 \times 10^6$ backup facility for the University of Arizona analog/hybrid computer laboratory! The sign in the window reads:

EMERGENCY USE ONLY
Break glass if EE Dept. electronic differential analyzer fails.

He Went Thataway!

Dave Taskett to Veep, Sales, Zeltex Inc., Concord, California.

Jerry Collins, to Veep, Engineering, Zeltex Inc., Concord, California.

Transactions Available


Proceedings of the Combined Analog/Digital Computer System Symposium, 16-17 December 1960, Philadelphia (18 pages, $5.00). Simulation Councils Inc., 8484 La Jolla Shores Drive, La Jolla, California.

Proceedings of the Second Annual San Diego Symposium for Biomedical Engineering (352 pages, $12.00). San Diego Symposium for Biomedical Engineering, 8484 La Jolla Shores Drive, La Jolla, California.

Call For Papers

Simulation Councils, Inc. is co-sponsoring (with the Institute of Aerospace Sciences) the “National Specialist Meeting,” Aug. 26-28, 1963, Columbus, Ohio, on “Simulation for Aerospace Flight.” Simulation Councils need 3 papers on subjects of Missile and Missile Systems Simulation. Contact Ralph O’Harra, Aerodynamics Dept., NAA, 4300 E. 5th Ave., Columbus 16, Ohio.

Meetings

WESTERN SIMULATION COUNCIL MEETING

HOST: NASA Ames Research Center
PLACE: Moffett Field, California
DATE: January 17, 1963
TIME: 9:00 A.M.–4:00 P.M.
SUBJECT: Lunar Mission Simulation and Simulators

May 21–23

Spring Joint Computer Conference sponsored by American Federation of Information Processing Societies, Cobb Hall, Detroit. For information write B. W. Pollard, program committee chairman, Burroughs Corp., 6071 Second Ave., Detroit 32, Mich.

ACCURATE STABLE DEPENDABLE NOISE GENERATORS

ELGENCO’s precision Low Frequency Gaussian Noise Generators have long been the standards for analog computer simulation studies. More recently ELGENCO’s precision, higher frequency noise generators have been used for high speed, repetitive analog computer studies, servo-mechanisms tests, countermeasure device developments, mechanical vibration testing, nuclear reactor studies, semiconductor parameter studies and many other applications. ELGENCO’s noise generators are known for their precise, stable and dependable output characteristics. For example, our Model 301A has the following specifications:

- Probability Distribution: Gaussian to better than +1% in excess of 4σ.
- Output Spectrum: Uniform to ±0.1 db from 0 to 35 cps. Spectral density is 4.0 (volts)² per cps.
- Output Level: 12 volts RMS: output mean less than 50 millivolts with 97% certainty.

SOME OF OUR OTHER GAUSSIAN NOISE GENERATOR MODELS:

- Model 321A: 0 to 100 cps
- Model 321A: 10 cps to 50 kcps
- Model 371A: two outputs 0 to 10 cps and 10 cps to 20 kcps

WRITE US ABOUT YOUR NOISE GENERATOR REQUIREMENTS. FOR MORE THAN 10 YEARS NOISE GENERATORS HAVE BEEN OUR MAJOR Endeavor.

CIRCLE 105 ON READER-SERVICE CARD

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