THE ELECTRON ART

Edited by FRANK ROCKETT

Designing Automatic Controllers by Electrical Analogues

DYNAMIC STABILITY and other performance criteria of automatic industrial controllers can be determined automatically using an electronic model of the system. Using this technique, the design of controllers is simplified by the Analaut (automatic analogue) designed by George A. Philbrick, G. A. Philbrick Researchers, Inc. (Boston, Mass.).

Electrical Analogue

The components of the controlled process are reduced to their electrical equivalents. The complete system, with either the actual controller or an electrical analogue of it, is then periodically shock excited and the recovery transients at appropriate points synchronously displayed on an oscilloscope. The behavior of the system for various adjustments of the process and controller is observed by manipulation of the electrical circuit in direct correspondance with variations of the actual physical constants. For example, effects of lag times or valve limits can be analyzed.

Various electrical circuits are used to represent plant equipment. A series of tanks so connected that the fluid cannot back up, as where one tank overflows into another, is represented by resistance-capacitance networks isolated by vacuum tubes; if the fluid can back up, the tubes are omitted. The inverse of the technique is used to synthesize practical processes and plants from the required physical reactions. In addition, because the electrical analogue compresses into fractions of a second plant reactions occupying hours, it provides a means of quickly and graphically teaching automatic control techniques to plant operators. A classroom model

Operator observes effect of variations in simulated process control

has recently been successfully used at Massachusetts Institute of Technology. Special models have been used in designing and improving industrial controllers, and others are being used in designing nonreciprocating aircraft engine controls.

Steepness of Pulse Fronts

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MOST ANALYSES of pulsed circuits assume that the wavefront of the pulse is a step function, such as

ELECTRONS RADIATE LIGHT

Electrons traveling at extremely high speed give off electromagnetic radiation directly. This electronic light has just been observed by Floyd Haber, laboratory assistant, working on the synchrotron in the General Electric research laboratory. The radiation, predicted in 1944 by two Russian physicists, D. Iwanenko and I. Pomeranchuk, is given off tangentially from the free speeding electrons, and appears as a bluish-white spot; the cross bar in the photograph is produced by refraction at the glass wall of the synchrotron doughnut. Calculations by Dr. J. S. Schwinger of Harvard University indicate that maximum energy of the radiation is in the visible or infrared portion of the spectrum, with only slight energy in the microwave region. Dr. H. C. Pollock, physicists in charge of the synchrotron, and Drs. R. V. Langmuir and F. R. Elder, his associates, are preparing a flat quartz window in the doughnut wall so that measurements of the spectral content of the radiation can be made. Comparison of the measurements with calculations will provide further insight into the nature of the electron