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Constant Reactor Outlet Temperature Control System for Nuclear Power Plants

by

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The problem of designing a constant reactor outlet temperature control system for a thermal reactor power plant is considered. The dynamic control characteristics of the power plant are described in terms of (1) the response of reactivity to variations of reactor inlet coolant temperature, (2) the heat transfer characteristics of the reactor and boiler, and (3) the time lags of the reactor coolant loop. It is shown how the inherent characteristics of the power plant may be used to advantage by constant reactor outlet temperature control systems employing the reactor inlet and outlet temperatures as control variables. An important feature of these control systems is the computation of the reactor inlet temperature from the boiler outlet temperature or the steam plant variables using recently developed transport delay circuits to compensate for the boiler-to-reactor coolant transport delay.

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A Van de Graaff Accelerator for Petroleum Exploration Research

by

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Techniques of nuclear physics have recently been applied to research problems in exploration for petroleum. Although radioactive well-logging has been employed in an empirical manner for a number of years, little is known of the fundamental nuclear processes which are involved. This paper describes the design and performance of a special $\frac{1}{2}$ million volt Van de Graaff electrostatic generator built by High Voltage Engineering Corporation for the Magnolia Petroleum Company's Field Research Laboratories. The instrument is of low cost but quite adequate for investigating nuclear properties of earth materials important to well logging. The Van de Graaff accelerator and the special housing and shielding facilities are described as well as the instrumentation used in connection with its safe and efficient use.

Neutron Radiation from the 130" Cyclotron

by

William F. Coombs, Jr.
University of Rochester

This paper will consist of a discussion of the neutron, and especially, fast neutron radiation problem from the Rochester 130" Synchrocyclotron. This machine accelerates protons to 240 MEV, and is in a rather open location. The survey methods and instrumentation will be presented. The talk will end with a presentation of the measures that are being taken to reduce the radiation hazard to personnel. These measures are largely based on the results of the various surveys mentioned above.

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Current Stabilization of Magnet Supplies

by

Kurt Enslein
University of Rochester

This paper will present a description of the various methods used in the Rochester installation to regulate the current through several magnets. These methods are as follows: (1) Regulation of app. 160 KW. for the main magnet. This consists of a shunt followed by a chopper amplifier, high level magnet magnetic amplifier to excite the field of the generator. The methods used for close control about any given values will be presented; (2) Regulation of a 50 Kw. generator for research magnets. This consists of a shunt, chopper amplifier, followed by a simple saturable reactor such as manufactured by Sorensen, controlling the field of the generator; (3) Regulation of a 540 Kw. generator for a cloud chamber. This system must go from 0 to 3,000 amperes in 1 second (tentative), and return to zero in about the same time. A thyratron type of control is used here to control the field of the generator. It is believed that the method is rather unique.

The emphasis throughout this paper will be on the decrease of amount of rotating equipment, such as amplidynes, exciters, etc.

Automatic Start-up for Nuclear Reactors

by

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A system of automatic start-up is described which has been used for over a year to start up BEPO (British Experimental Pile). A signal from a reactor period-meter and from a power level meter are fed into the control rod servo system. The neutron power builds up with a demanded doubling time and then levels off to a demanded power level. The demanded power setting is then increased uniformly to bring the reactor temperature up to operating level at a constant rate.

The characteristics of this system are described together with some of the problems encountered in applying it to certain types of reactors. A new type of logarithmic D.C. amplifier and period meter is described that covers a range of currents of up to eight decades.

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Automatic Control and Readout for Beta Ray Spectrometer

by

Alvin Read
Iowa State College (Ames)

The Ames Laboratory has recently completed an automatic control and readout system for a beta ray spectrometer which is thought to be more versatile and convenient than any heretofore published. The system provides suitable magnet current, sweeps it by increments, and provides control functions for taking and permanently recording data on a 10 key printing adder.

A second system now under construction is similar but more versatile, among other features allowing recording of prompt or delayed coincidences.

Some Remarks on Data Handling Systems

by

Robert L. Chase
Brookhaven National Laboratory

In complicated automatic counting systems accumulating large quantities of numerical data, it is sometimes justified to devote considerable effort to the development of reliable data recording equipment. In the case where the data require extensive processing after collection it may be advisable to record it directly on punched cards or tape so that it may be fed directly to a digital computer. Where no extensive calculations are to be made, a printed or typewritten record is often desirable.

Two systems will be described: the first collects data from a neutron diffraction spectrometer and stores it on Remington Rand punched cards; the second stores data from six counting experiments in glow tube scalers which are read periodically into an electric typewriter.

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Multi-Tracer Measurements in Living Tissues

by

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Radiation Laboratory, University of California

The dynamic variations in concentrations of injected tracers observed in living systems with external counters can be greatly extended by a method of independently recording the simultaneous concentration of multi-tracer materials.

Such measurements can be made with a proportional counter feeding multi-scaling circuits each of which contains a differential discriminator.

Illustrative data from representative material involving two simultaneously injected tracers will be presented.

This investigation is being conducted by Dr Ernest Dobson and Dr George Warner at the Donner Laboratory of Medical Physics, University of California, Berkely, California, and supported by the Atomic Energy Commission.

High Current Photomultiplier

by

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The photomultiplier tube to be described is primarily designed to collect light pulses from an elongated scintillator source which emits light from its entire length. When uniformly illuminated over its 8 inch long X 0.4 inch wide photocathode, the tube will be linear up to an output pulse current exceeding 2 amperes. The maximum current will exceed 3 amperes. It will deliver such currents into load impedances as high as 125 ohms. The tube is $3\frac{1}{2}$ inches in diameter and $13\frac{1}{2}$ inches long.

The center section of the electron multiplier is an in-line electrostatically focused structure similar to those designed and used by many others. The lengths of the dynodes, however, perpendicular to the electron flow, are 8 inches; many times longer than those in conventional tubes.

The cathode, first dynode, final dynode, and collector geometries are especially designed at N.R.L. to provide efficient collection of photocathode current, minimum transit time spread, and large output current.

The photocathode is a Nesa undercoated Cs_3-Sb surface. The surfaces have an electron gain of approximately 9 for a 3 dynode voltage of 500 volts. The spacings and general construction in the tube are such as to allow the application of higher voltages than are usually encountered in commercial photomultipliers.

At the time of writing this abstract, equipment for measuring the frequency response of the tube has not been built. However, it is designed to detect very short duration and fast rising light pulses and the upper cutoff frequency is expected to exceed 50 megacycles.

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A Radioactive Battery Excited Electrostatic Charger for Radiation Dosimeter

by

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Radiation Research Corporation
West Palm Beach, Florida

The principle of mechanical separation of charge produced by electrostatic induction is used to convert manual mechanical energy to electrical energy for the charging of the conventional direct reading quartz fiber type of radiation dosimeter. The mechanical separation of charge is obtained by circular motion of the rotor plates of an air dielectric capacitor. The rotor plates when grounded are charged by induction by the electric field of the stator plates which are connected to a high voltage radioactive battery.

In operation each cycle of the rotor transfers the induced charge continuously to the dosimeter by means of sliding contacts. The potential across a substantially capacitative load may be continuously increased or decreased as a function of the direction of rotation of the rotor. This new type of electrostatic generator supplies charge at its maximum rate immediately requiring no regeneration time and is simpler, more reliable and more compact than conventional electrostatic generators.

The mathematical analysis of the generator operation will be discussed as well as the physical and engineering details. Several models will be demonstrated.

The design and development of this apparatus is being conducted under the auspices of U.S. Navy Bureau of Ships under contracts NObsr-63046 and NObsr-64155 through the direction of Messrs G.N.Mahaffey, J.M.Stevenson, and S.C.Rainey.

Messrs J.H.Coleman, H.C.Gibson, Jr, and T.G.Elz of the Radiation Research Corporation also contributed substantially to this development.

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Pulsed Geiger Counters

by

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Two small stable and accurate radiac instruments have been developed for the Armed Services using the pulsed geiger counter principle. The circuitry discussed in the paper gives these instruments the following characteristics: (1) Common geiger tubes which normally saturate at the range of five R/HR can be used to detect radiation intensities above the region of five hundred R/HR. (2) Accuracies of the order of 20% can be maintained throughout wide climatic variations over long periods of both operating and storage life, and upon and after replacement of circuit elements. (3) The instrument is small, in the order of approximately 2 lbs., and can be operated by common flashlight batteries. (4) Accuracy over the energy range of 80 Kev to 2 Mev of greater than 40% can be obtained.

A discussion of the type of circuit design necessary to achieve the previously mentioned advantages will be made and charts illustrating the performance of two equipments designed in accordance with the pulsed geiger counter principle will be displayed. Photographs of these equipments, each weighing less than 3 lbs. and occupying a volume of less than 50 cubic inches, will also be presented.

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