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THE METOD OF NONLINEAR CONVERTING OF ELECTRICAL SIGNALS FOR CONTROL AND DRIVING SYSTEMS OF THE NUCLEAR PHYSICS EQUIPMENT

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There is need for devices of nuclear physics, in particular in nuclear reactors control systems, which are carrying out nonlinear transformations. It is possible to believe to them logarithmic amplifiers, meter the period of nuclear reactor etc. The methods of functional transformation of electrical signals and opportunity construction of devices with nonlinear transformation on the basis of the offered methods of definition of a voltage in structures with distributed potential on them are investigated in the work. These devices have a wide dynamic range, high speed of transformation and stability of parameters. The peculiarity of them is the possibility to construct the devices by the given beforehand law of transformation function. The variants of realization of functional converters are presented.

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VAN-DE-GRAAFF GENERATOR BEAM CONTROL SYSTEM

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Ion beam control system lightens the work for controlling the generator's state, guiding the beam to experimental setups, and monitoring it when experiments are made.

The system provides beam tracing along an ion-guide, measuring beam current before and after distributing magnet and beam electric charge at exposed sample, indirect evaluation of beam current before an experimental chambers where scattered ions are detected.

The system consists of three devices for beam measuring and observing that are a rotating beam chopper with a semi-conductor detector for detecting scattered ions and a current integrator. The devices for beam measuring and observing provide beam current measurements in the range of 50 nA ÷ 10 μA, and beam profile and position observation by placing Faraday cup and fused silica at the axis of the beam. Beam positioning is done with a help of an electromagnet built in the ion-guide's vacuum system.

The semi-conductor detector provides indirect measurement of the beam current before experimental chamber. Beam current is to be proportionate to the number of detected ions scattered by the rotating beam chopper. Planes of the chopper and of the semi-conductor detector were placed at angles of 45° and 90° to the beam axis correspondingly.

Beam current at an exposed sample is measured with a help of the current integrator that works on the principle of charging-discharging of a capacitor. Conversion ratio of the current integrator is 1 pulse/nC. An electric charge value taking from the capacitor in each of the cycle is equal to the product of voltage and capacity values. The current is measured in a range of 0.2 nA ÷ 10 μA with a linearity not worse than ± 2%.

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A USE OF A VAN-DE-GRAAFF GENERATORS FOR NUCLEAR PHYSICS MEASUREMENTS

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The present report describes an EG-2 Van-de-Graaff generator that has built at the IAP NUU and has following parameters: accelerated proton energy is in a range of 0.3÷2.0 MeV with monochromaticity of 10^{-4}, beam current is 50nA÷10μA.

Van-de-Graaff generators provides high monochromatic (~10^{-4}) beams of various ions with currents of ~10^{-4}A and energies that are continuously adjustable within a range of 0.1÷10 MeV. These characteristics of the generators as well as compactness and simplicity of their construction and maintenance have led to a wide use of the generators for nuclear physics measurements.

Modern conceptions of nucleus structure and nuclear reactions nature have been considerably developed due to measurements at the Van-de-Graaff generators with energies up to 10 MeV. An important information about density function of neutron spectra nuclear levels and about a nature of one-particle excited states of nuclei and their quantum characteristics were obtained when reactions of (p,n), (d,p) and (t,α) types were measured. Measurements of (α,p) = (p,α) type direct and back reactions were used to study nuclear systems symmetry features in regard to their time inversion. Fissionabilities of several tens of short-half-life heavy nuclei were studied by measuring (p,p′f), (d,pf), (t,pf), (α,α′f), (^{3}He,df)