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Computer Code Abstracts

PLATYPUS

1. Name of code: PLATYPUS
2. Computer for which code is designed: IBM 7070, 7074
   Programming system: Autocoder 72
3. Nature of the problem solved: Performs simple reactivity and economic calculations for low enrichment uranium and plutonium reactors. The first part of the program uses the series methods of R. L. Murray (see reference below) to calculate the reactivity and isotopic fuel composition of a homogeneous core running at constant power. The core life is divided into discrete time steps, each step being determined by specifying the final value of one of four quantities: time, burnup, irradiation, or k_{eff}. The second part of PLATYPUS, which can be run with or without part one, computes the fuel and running costs of the reactor throughout its life. As a whole the program is suited for survey calculations and the investigation of design trends.
4. Restrictions on the complexity of the problem: Homogeneous core; flux shape and core parameters constant throughout a particular time step; single energy group, one space point diffusion model used.
   Machine requirements: Program uses IBM 1401 for input–output processing.
5. Typical running time: The whole program, including the economics calculation, takes one to three minutes depending on problem options.
6. Unusual features: During each time step the reactor is maintained just critical by the addition or removal of a fictitious control poison in the moderator. The differential equations describing changes in fuel composition are solved analytically as functions of irradiation and an iteration is carried out to find the irradiation corresponding to the specified final value of time, burnup, or k_{eff}. At the end of each time step the basic lattice parameters can be altered and the next stage run. In this way a variety of reactor control systems can be simulated.
7. Present status: In use: source deck, object deck, and special operating instructions not yet available.
8. *References:* R. L. Murray, S. A. Hasnain, and A. L. Mowery Jr., "Reactor Fuel Cycle Analysis by Series Methods." *Nucl. Sci. Eng.* **6,** 18–25 (1959).
   J. Hill and J. M. Illingworth, "PLATYPUS—An IBM 7074 Programme for the calculation of lifetime and running costs of reactors". RRA/AP/102 (Internal report) (October 1962).

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MO332

1. Program name: MO332
2. Computer for which program is designed: Philco-2000
   Programming system: FORTRAN II
3. Nature of problem solved: MO332 is a one energy, Monte Carlo calculation of the fraction of neutrons absorbed in spheres randomly distributed in one region of an otherwise one-dimensional, three-region cell. A three-dimensional box is loaded in a random manner with spheres. The spheres are not allowed to be cut by the set of parallel faces of the box which form interfaces with nonhydrogenous regions on two opposite sides of the box. In the other two directions the box is assumed to repeat indefinitely, so that the spheres may be cut by these box faces. A sphere cut by one or two of these faces gives rise to one or three spheres outside the box, leaning into the box, and displaced from the original sphere along one or two transverse coordinate axes by the transverse width of the box. The faces of the nonhydrogenous regions opposite their interfaces with the box adjoin hydrogen-containing regions. There is a symmetry boundary plane on the outside of each such region, while the transverse sides of both types of regions outside of the box have a repeating boundary condition to correspond with the box. The neutron source is flat in the hydrogen-containing region. Individual neutrons are followed in their wanderings through the box and the pair of regions on both sides of the box. Absorption and isotropic (in the lab system) scattering are included in all regions. In addition, in the hydrogen containing region the hydrogen scattering is treated as isotropic in the center of mass. The box can be reloaded with a different random distribution of spheres in the course of the calculation.
4. Restrictions on the complexity of the problem: 200 spheres in the box, 100 box loadings, 100 experiments per box loading, 500 histories per experiment.
5. Typical running times: With 100 spheres in the box making up 10% of the volume of the box the following times are representative:
   0.19 min to load the box
   4.3 min per 100 histories
   0.5–1.0 hr over-all, to get a reasonable answer.
6. Unusual features of the program: See comments in the accompanying MO322 abstract.
7. Present status: In use.
8. *Reference:* R. M. Cantwell, "MO322 and MO332—FORTRAN Programs for Calculating Neutron Absorption in Spheres Distributed Randomly." WAPD-TM-352 (October 1962).

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