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Computer Code Abstracts

ZORCH

1. Code: ZORCH
2. Computer for which code is designed: IBM 7090
   Programming system: FORTRAN II
3. Nature of problem solved: The time dependence of reactor power, pressure, and inverse period and the space and time dependence of fuel and moderator temperatures are calculated during a transient in the Molten Salt Reactor Experiment, using a simplified space-dependent kinetics model. Fuel inlet temperature may be specified at up to 50 time points, with piecewise linear time dependence. Input reactivity may be specified as an initial step and/or ramp, followed by up to 50 successive ramps.
4. Restrictions:
   250 space points for axial temperature calculation
   1 neutron energy group
   Up to 7 delayed neutron precursors
   4 or 5 tape units (input, output, two tapes for intermediate storage, and one tape for input to digital x-y plotter. If no plotter is available, a dummy subroutine may be substituted for the plotting subroutine and only 4 tape units are needed.)
5. Typical running time: Variable, depending on number of basic time steps, frequency of temperature calculation and frequency of output. A case with 200 time steps and a temperature calculation every 20 time steps was run in about 3 min.
6. Unusual features: Reactor power, pressure, and inverse period are printed at specified times. At the specified stop time, the fuel and moderator temperatures are printed as functions of position for each temperature calculation, and this is followed by a rough plot (using the output printer) of power as a function of time. In addition an input tape can be prepared for an x-y digital plotter (Calcomp 570-R) which will produce graphs of fuel and moderator temperature versus position at specified times.
7. Present status: In use, available.
8. *References:* 1. C. W. Nestor, Jr., MURGATROYD—An IBM 7090 program for the analysis of the kinetics of the MSRE. ORNL-TM-203 (April 1962, addendum May 1962).
   2. C. W. Nestor, Jr., ZORCH—An IBM 7090 program for the analysis of simulated MSRE power transients with a simplified space-dependent kinetics model, ORNL TM 345, Sept. 18, 1962.

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GMCM-9

1. Code name: GMCM-9
2. Computer for which code is designed: IBM 7090
   Programming system: Fortran II
3. Nature of the problem solved: GMCM-9 is a time dependent, multienergy group, multiregion, three dimensional, Monte Carlo solution for reactor and shielding problems. The geometry of the system to be studied is mocked up by using a series of surfaces described by the quadratic equation

$$AX^2 + X_0X + BY^2 + Y_0Y + CZ^2 + Z_0Z = K.$$

   The solution is time dependent in that each particle or its descendent is followed for a period of time (the time is the time as kept by the particle) specified by an input number. The particle or its descendent which survives the time period is saved on tape so that it can be used as a source for the next time step. The particle referred to is a group of N neutrons, $0 < N < \infty$. N is called the weight of the particle. The microscopic cross sections must be imputed by cards.
   The following results are tabulated for each time period:
   (a) The number of particles and neutrons leaking from the system.
   (b) The number of neutrons entering any three regions of the system versus energy.
   (c) System criticality.
   (d) Number of neutrons absorbed and scattered elastically and inelastically.
   (e) Number of fission neutrons born versus energy.
   (f) Number of particles and neutrons starting and ending their life history for a given time period.
   (g) Neutron flux and dose rate versus region and energy group.
   (h) Number of neutrons crossing from region L to region L' (maximum of 10 L, L' pairs).
   (i) Number of times the collision routine was entered, the number of neutrons born in fission, and the number of neutrons scattered elastically and inelastically versus material and energy group.
   (j) The number of neutrons and particles that fall below the energy cutoff.
   (k) The last random number used in the calculation.
4. Restrictions on the complexity of the problem: Maximum number of energy groups $\leqq 32$. Because the storage required for geometry description, material descriptions, and certain results can be "traded" by the code, there are very few restrictions on the problem size. In other words the geometry description can be extremely complex if, say, the material description is simple—or the material description can be complex if the geometry