Computer Code Abstracts*

APWRC-CELCOR

1 Name of code: APWRC-CELCOR
2. Computer for which code is designed: IBM-709 or 7090
   Programming system: FORTRAN II including FAP
3. Nature of problem solved: Multiple lethargy level cell corrections using P1 or S2 to S16 DSN fluxes in cylindrical, spherical and one- or two-dimensional slab geometry.
4. Restrictions on the complexity of the problem:
   10 lethargy levels; cell temperature 68–2980°F.
   10 mixtures, five materials per mixture
   25 regions per direction
   199 intervals per direction
   P1, S2, S4, S6, S8, S16; no S16 for cylinder.
   Machine requirements: 32K memory, nine tape units; card reader not necessary.
5. Typical running time: 6 min for two-dimensional cell with 20 intervals in each direction, S6 theory with flux convergence of 0.001, and 10 lethargy levels.
6. Unusual features of code: Program uses GE-ANP nuclear data tape format and lethargy level scheme. Assumption of flat flux at an arbitrary epithermal reference lethargy level is used to obtain a boundary condition on the slowing-down density in each region. The slowing-down density is obtained at each higher lethargy (lower energy) level using regional material cross sections and the Modified Age Theory equation for the slowing-down density. Effect of leakage from adjacent regions on slowing-down density is accounted for by adding a leakage term to the absorption cross section used in slowing-down density equation. The leakage term is assumed zero at the reference level. A value for a particular level is calculated from the regional interface currents and region average flux at the preceding level. Thus the leakage per unit flux is assumed to vary slowly with lethargy. The regional slowing-down density at each level is used as the source term for the spatial flux calculation at that level. At all epithermal levels, in-group scattering is assumed to be zero and "xi-sigma" scattering is added to the pure absorption. Two-dimensional slab geometry cell corrections are obtained by assuming two-dimensional flux shape occurs only in fissionable part of cell, where the fluxes are assumed separable. Nonfissionable part of cell (side plates of box, etc.) assumed to have flux variation only in direction parallel to plane of fuel plates. Cell corrections may be defined to be unity in the moderator or total cell average flux normalization may be used. Input data FORMAT and logical error diagnostics. Output includes on-line topological material edit for checking input data, and complete off-line edit with optional Benson-Lehner plotting data. Written under U. S. Army Pressurized Water Reactor Code Development Program.
7. Present status: In production; source and object programs with nuclear data file available on receipt of one full length magnetic tape. Three-thermal-group spectral hardening may be added in future. Requests should be submitted to: Mr. Clement Eicheldinger, Mail No. W-719, The Martin Company, Baltimore 3, Maryland.
8. *Reference:* G. A. Cannon, APWRC-CELCOR, A FORTRAN II program for multiple lethargy level P1 or S2 to S16 DSN cell corrections in cylindrical, spherical and one or two-dimensional slab geometry. MND-C-2459 (December 27, 1960).

G. A. Cannon
T. M. Olsen
E. A. Schaefer
The Martin Company
Baltimore, Maryland

WHIRLAWAY

1. Name of code: WHIRLAWAY
2. Computer for which code is designed: IBM-7090
   Programming system: FORTRAN
3. Nature of problem solved: Two-group, three-dimensional, neutron diffusion equations in XYZ geometry
4. Restrictions on the complexity of the problem:
   Maximum number of groups—2
   Maximum number of mesh points—12,750
   Maximum number of compositions—100
   Maximum number of regions—100
5. Typical running times: approximately 0.006 sec/pt.-iteration—from 1½ to 4 hr for a 10,000 point problem
6. Unusual features of the code: This code uses the same simple iterative procedure that is used in the two-dimensional code EQUIPOISE. It will compute adjoint fluxes and flux-adjoint flux regional integrals automatically if desired.
7. Present status: In use, available
8. *Reference:* T. B. Fowler and Melvin Tobias, WHIRLAWAY—A three-dimensional neutron diffusion code for the IBM-7090 computer. ORNL-3150 (July, 1961).

T. B. Fowler
Melvin Tobias
Oak Ridge National Laboratory
Oak Ridge, Tennessee

GAM-I

1. Code designation: GAM-I; A Consistent P_1 Multigroup Code for the Calculation of the Fast Neutron Spectrum and Multigroup Constants.

* Computer codes for this section should be submitted directly to Everitt P. Blizard, Editor, *Nuclear Science and Engineering*, Oak Ridge National Laboratory, P.O. Box X, Oak Ridge, Tennessee.