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Computer Code Abstract

PDQ-7

1. Name of Program: PDQ-7
2. Computer for Which Program is Designed and Programming Language Used: CDC-6600, FORTRAN IV.
3. Nature of Physical Problem Solved: PDQ-7 solves few-group neutron diffusion-depletion problems in one, two, and three dimensions. Adjoint solutions are also available and two overlapping thermal groups may be used in one- and two-dimensional problems. Either pointwise or regionwise depletion may be performed using the HARMONY depletion system. The geometry may be rectangular, cylindrical, or spherical in one dimension; rectangular, cylindrical, or hexagonal in two dimensions; and rectangular or hexagonal in three dimensions. All geometries provide for variable mesh spacing in all dimensions. Zero flux, zero current, and rotational symmetry boundary conditions are available, and boundary value problems may be solved by specifying the flux values on one or more boundaries.
4. Method of Solution: Difference equations are obtained at each point by integrating the differential equations over an appropriate mesh element. The resulting equations are three-point, five-point, and seven-point in one, two, and three dimensions except for hexagonal geometry, where the number of points is increased by two. The group equations are solved using a single-line cyclic Chebyshev semi-iterative technique and the source iterations are accelerated by a procedure based on Chebyshev polynomials.
5. Restrictions on the Complexity of the Problem: The total number of groups is limited to five. The product of groups and points cannot exceed 300 000 and the plane size in three-dimensional problems is restricted to 8000 points.
6. Related and Auxiliary Programs: HARMONY tablesets may be input on cards or may be obtained from a file generated by a cross-section program. On request, PDQ-7 will prepare output files containing flux, concentration, power, integral, and geometry data, and these files may be further processed in auxiliary programs.
7. Typical Running Time: The running time in hours may be estimated by dividing the product of groups and points by 150 000. The actual time may vary widely from this estimate due either to special convergence difficulties or to the complexity of the depletion formulation.
8. Status: The program has been in use since June 1, 1966, and may be obtained by domestic users from the Argonne Code Center.
9. Machine Requirements: The central memory size must be at least 64K and there must be four nonsystem disks, each on its own channel.
10. Operating System Under Which Program is Executed: SCOPE 2.0.
11. Other Programming Information: The required software environment is described by Pfeifer.[3] It includes routines for program loading, input conversion and processing, storage and retrieval of permanent files, scratch input-output, and storage allocation.
12. *References*:

[1]W. R. CADWELL, "PDQ-7 Reference Manual," WAPD-TM-678, Westinghouse Electric Corp. (January 1967).

[2]R. J. BREEN, O. J. MARLOWE, and C. J. PFEIFER, "HARMONY: System for Nuclear Reactor Depletion Computation," WAPD-TM-478, Westinghouse Electric Corp. (January 1965).

[3]C. J. PFEIFER, "CDC-6600 FORTRAN Programming - Bettis Environmental Report," WAPD-TM-668, Westinghouse Electric Corp. (January 1967).

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