Computer Code Abstracts

TRANZIT

1. Name or Designation of Program: TRANZIT.
2. Computer for Which Program is Designed and Others upon Which it is Operable: CDC 7600, CDC 6600.
3. Nature of Physical Problem Solved: TRANZIT[1] solves multigroup time-dependent particle transport problems in finite ρ,z cylindrical geometry. Problems solved are subject to a variety of boundary conditions including albedos and specification of the incoming angular flux at the right, top, or bottom of the cylinder. A time-dependent, anisotropic, inhomogeneous, distributed source that is separable in space-time may be used. No provision is made for including a fission source. A first collision source due to an energy-distributed point source on the axis of a system with material properties nonuniform in the z-direction is treated. General anisotropic scattering problems are treated.
4. Method of Solution: Energy dependence is treated by the multigroup approximation and angular dependence by a discrete ordinates approximation. The space-time variables are approximated by the weighted-diamond difference scheme. Anisotropic scattering and anisotropic inhomogeneous sources are represented by finite spherical harmonics expansions. A first collision source option evaluates the analytic uncollided flux due to a point source on the cylinder axis in a medium which may have z-dependent cross sections and uses this flux to compute a first collision source for further transport. Time differencing is also variable between the Crank-Nicholson (diamond) and completely implicit (step) schemes. The resulting scheme is stable and can be accurate but requires within-group iteration at each time step. Coarse-mesh rebalancing acceleration of these within-group iterations is performed.
5. Restrictions on the Complexity of the Problem: The variable dimensioning capability of FORTRAN IV is used so that any combination of problem parameters leading to a blank common vector length of less than MAX can be used. This is slightly greater than 25 000 words for the CDC 7600. With a few exceptions, only within-group problem data are stored in fast memory, and data for all other groups are stored in auxiliary storage; current angular flux is stored on disk. Arbitrary numbers of groups of up- or downscattering are allowed.
6. A ten group, S_6, P_2 scattering, 28×40, first collision source problem ran 18 time steps per hour on the CDC 7600. A three group, S_4, 4×6, up- and downscattering, isotropic source and scattering test problem required 0.3 min on the CDC 7600.
7. Unusual Features of the Program: Unusual features include coarse mesh convergence acceleration, first collision source option, input specification of top, bottom, or right boundary fluxes, fine mesh z-dependence of cross sections, a variety of boundary conditions, generalized anisotropic scattering and anisotropic inhomogeneous source option, built-in discrete ordinates constants (S_2, S_4, . . . S_{16}), and FIDO cross-section input option.
8. Related and Auxiliary Programs: None.
9. Status: In use.
10. Machine Requirements: Six output units (disk, drums, or tapes) in addition to three system input/output units are required. A CDC extended core storage unit or a large bulk memory is also required. (Disk, drums, or tapes can be substituted for this requirement.)
11. Programming Language Used: FORTRAN IV with a small amount of mixed integer floating arithmetic and generalized subscripting used. Minor use of 10 H Hollerith formats, decode, and encode statements.
12. Operating System or Monitor under Which Program is Executed: CROS (Los Alamos operating system for CDC 7600).[2]
13. Other Programming or Operating Information or Restrictions: The system subroutine XIT, which assigns a return address for CDC arithmetic errors, and plotting routines for contour flux displays may easily be removed.
14. Material Available: FORTRAN deck, test problems, and test problem results are available from the Oak Ridge Radiation Shielding Information Center.
15. Acknowledgment: Work performed under the auspices of the U.S. Atomic Energy Commission.
16. *References*:

[1]K. D. LATHROP, R. E. ANDERSON, and F. W. BRINKLEY, "TRANZIT: A Program for Multigroup Time-Dependent Transport in (ρ, z) Cylindrical Geometry," LA-4575, Los Alamos Scientific Laboratory (1971).

[2]"Elementary Guide to the Control Data 7600," RAY DAVENPORT, Ed., Programmer's Information Manual, Vol. 5A, Los Alamos Scientific Laboratory (1972).

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