Computer Code Abstract

WANSY

1. Name of Code: WANSY[1]

2. Computer for Which Program is Designed: CDC-6600
Programming Language: FORTRAN IV

3. Nature of Physical Problem Solved: WANSY solves the two-dimensional (rectangular or cylindrical geometry) static group diffusion equations by synthesis methods.

4. Method of Solution: The program uses the space-synthesis approximation with axially discontinuous trial and weight functions.[2] Different numbers of trial and weight functions may be used in different trial function zones. The synthesis may be group dependent, partially or totally group collapsed.[3,4] When collapsed group synthesis is used, an option exists for the use of scaling functions which adjust the group ratios of the weight functions.[3] The synthesis equations are solved numerically for the eigenvalue and flux mixing coefficients using the Wielandt method.[5]

5. Restrictions on Complexity of the Problem: The number of energy groups, G, must be ≤ 8, and the number of trial (and weight) functions per trial function zone must be ≤ 15. If NzPTS is the number of axial mesh points, K is the maximum number of trial functions used in any zone, and G' is the number of effective groups after group-collapsing, then $4 \times \text{NzPTS} \times (G' \times K)^2 \lesssim 25\,000$.

6. Related and Auxiliary Programs: WANSY uses the WANDA[6] program to generate the trial and weight functions and to obtain the integrals necessary for the synthesis solution. This modified version of WANDA is contained within WANSY.

7. Running Time: Because of the many options available in the WANSY program, absolute running times are not quotable. A cylindrical 4-group problem with 34 radial and 40 axial mesh points which uses nine trial function zones and eight different trial-weight functions (with two trial-weight functions used per trial function zone) within a partially collapsed group scheme with weight function scaling required 3.2 min of computing time on a CDC-6600 computer.

8. Unusual Features: The synthesis methods used in WANSY present many options. Options exist for the use of direct or adjoint flux weighting; these functions may be axially discontinuous and may be used in a group-dependent fashion or in a partially or totally collapsed scheme with the group ratios of the weight functions altered via user specified parameters. The net synthesized pointwise group fluxes are constructed, normalized such that they may be compared conveniently with PDQ-7[7] flux shapes, and edited in any or all groups.

9. Status: The program is in production use.

10. Machine Requirements: The program was written for a CDC-6600 with a central memory size of at least 64K. In addition to an on-line card reader and printer, one system disk and two nonsystem disks, each on its own channel, are required.

11. Operating System and Environment: The software environment, as well as a description of hardware, are contained in Refs. 8 and 9. This version of the program is designed to run under the SCØPE 3.1 operating system.

12. Miscellaneous Programming Information: The WANSY program consists of a root, and four primary overlays or segments.[8] At any given time during execution of the program, the root and only one primary may reside in central memory. Overall program control is vested in the root. The primary overlays are loaded, one at a time, and one control is passed to them via calls on NEXT[8] in the root. Each primary overlay consists of reading input via INP[8] performing certain arithmetic operations, and creating scratch disk files to be passed to another segment.

All storage allocation is done dynamically in blank common by FINK/PANTRY.[9] Scratch disk files are read and written by calls on PANTRY. Blank common is declared in the root and given a length of one. When a primary is loaded the actual length of blank common (i.e., the remaining core from the end of all absolute text to field length) is obtained through the system labeled common block SIZE[8] and passed to FINK/PANTRY. All primaries are loaded at blank common origin which is defined to be the last location of the root text plus one.

13. *References:*

[1]J. B. YASINSKY, J. W. MARINACCI, and A. V. VOTA, "WANSY—A Program to Solve the Static Two-Dimensional Group Diffusion Equations by Synthesis Methods," WAPD-TM-891 (1969).

[2]J. B. YASINSKY and S. KAPLAN, *Nucl. Sci. Eng.*, **28**, 426 (1967).

[3]R. A. RYDIN, "Time Synthesis—A Study of Synthesis Modes and Weighting Functions," *Trans. Am. Nucl. Soc.*, **10**, 569 (1967).

[4]J. B. YASINSKY, and S. KAPLAN, *Nucl. Sci. Eng.*, 31, 354 (1968).

[5]E. L. WACHSPRESS, "Iterative Solution of Elliptic Systems," Prentice-Hall, Inc., Englewood Cliffs, N.J. (1966).

[6]O. J. MARLOWE and M. C. SUGGS, "WANDA-5, A One-Dimensional Neutron Diffusion Equation Program for the Philco-2000 Computer," WAPD-TM-241 (1960).

[7]W. R. CADWELL, "PDQ-7 Reference Manual," WAPD-TM-678 (1967).

[8]C. J. PFEIFER, "CDC-6600 FORTRAN Programming—Bettis Environmental Report," WAPD-TM-668 (1967).

[9]H. BOHL, Jr. and O. J. MARLOWE, "The FINK/PANTRY Data Storage and Retrieval System for a Computer," WAPD-TM-710 (1967).

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Received August 18, 1969
Revised September 18, 1969

Corrigenda

R. D. SHELTON, H. E. STERN, and J. W. WATTS, "Advantages of Using a Combination Electromagnetic and Material Shield," *Nucl. Sci. Eng.*, **36**, 304 (1969).

On page 306, in the right-hand column, first sentence should read: "For a small range in proton momentum, Δp, we may consider the *incoming* particle distribution . . . ," where the italicized work has been added.

On page 306, Eq. (14), and on page 307, Eqs. (16), (18), and (19), change 4 to 2.

The authors wish to express their appreciation to Dr. F. S. Alsmiller, Oak Ridge National Laboratory, for pointing out the above errors and for her helpful discussion concerning the paper.

T. B. FOWLER and D. R. VONDY, "Computer Code Abstract CITATION," *Nucl. Sci. Eng.*, **38**, 190 (1969).

The two references, Item 16, should read:

1. T. B. FOWLER and D. R. VONDY, "Nuclear Reactor Core Analysis Code: CITATION," ORNL-TM-2496, Oak Ridge National Laboratory (1969).
2. N. M. GREENE and C. W. CRAVEN, Jr., "XSDRN: A Discrete Ordinates Spectral Averaging Code," ORNL-TM-2500, Oak Ridge National Laboratory (1969).