Computer Code Abstract

XLACS

A Program to Produce Weighted Multigroup Neutron Cross Sections from ENDF/B

1. Name of Program: XLACS (Ref. 1).
2. Computer for Which Program is Designed: IBM 360 Series.
3. Nature of the Physical Problem Solved: XLACS calculates fine-group averaged neutron cross sections from ENDF/B data.[2] Its primary purpose is to produce full range multigroup libraries for the XSDRN program.[3] It also serves this purpose in the AMPX system.[4,5] Provisions are included for treating fast, resonance, and thermal ENDF/B data. Fine-group energy structures and expansion orders used to represent differential cross sections for XSDRN can be arbitrarily specified by the user. Cross sections can be averaged over an arbitrary user-supplied weighting function or by any of several built-in weighting functions.
4. Method of Solution: In the resolved resonance range, XLACS accepts either single- or multilevel Breit-Wigner parameters and calculates infinite dilution and background cross sections consistent with the Nordheim integral treatment[6] used in XSDRN. Doppler broadening is provided through the use of ψ and χ routines.[6] The unresolved treatment, which stems from MC^2 (Ref. 7), has been modified to accommodate the overlap of unresolved resonance sequences. Unresolved cross sections include some shielding effects through a $(1/\sigma_t)$ weighting and can include Doppler broadening. Smooth cross sections are calculated by averaging the ENDF/B point data over either a user-supplied spectrum or one of several built-in functions. Elastic scattering matrices are computed from the scattering angular distribution data specified as Legendre expansion coefficients. An inelastic scattering treatment is provided for ENDF/B File-5 data (LF = 1, 3, 5, 7, 9, and 10) using either a discrete level or an evaporation model. Thermal cross-section matrices are calculated through the use of procedures taken from the FLANGE-II code[8] or optionally by an analytical free gas treatment.
5. Restrictions on the Complexity of the Problem: The principal restriction is the availability of adequate core storage. The program is variably dimensioned, which means that array sizes are set for the particular problem at execution time. Core storage requirements are not affected by the number of nuclides in a case.
6. Typical Machine Time: (Times quoted are for the IBM 360/91.) Typical running times are difficult to define because they are functions of parameters such as (a) number of resonances, (b) number of groups, (c) Doppler broadening, and (d) number of thermal scattering kernels being calculated. A ^{239}Pu calculation with 123 groups (30 thermal), one thermal kernel, and Doppler broadening takes 6.72 min. The calculation of both Fe and H_2O with 123 groups (30 thermal) and one thermal kernel takes 4.74 min.
7. Unusual Features of the Program: In contrast with most ENDF/B processing programs, the variable dimensioning technique employed by XLACS permits optimal use of available core storage. The program treats both fast and thermal ENDF/B data in a single calculation. Mixed ENDF/B tape modes (BCD and binary) are permitted. For convenience, editing, updating, and plotting capabilities are provided.
8. Related and Auxiliary Programs: The XSDRN tape format produced by XLACS is somewhat more general than the tape format used by present XSDRN codes. An auxiliary program, CONVERT, is available to convert to the usable format.
9. Status: The program is in production use at Oak Ridge National Laboratory (ORNL).
10. Machine Requirements: IBM 360 series computer with a minimum of 330K bytes of core storage. External storage such as magnetic tape or disk devices must be available. The use of these devices depends on the characteristics of the problem.
11. Programming Language: The program was written in IBM 360 FORTRAN IV H level.
12. Operating System: IBM ØS 360 with the FORTRAN H compiler (MVT version 20.1).
13. Other Programming Information: The program consists of 158 subroutines on ~12 000 source cards. The program is presently used in a three-level overlay structure consisting of 19 separate segments. With this structure, ~330K bytes are required on the IBM 360/91.
14. Material Available: Source decks for XLACS and the auxiliary program CONVERT can be obtained through the Radiation Shielding Information Center (RSIC) at ORNL or the Argonne Code Center at ANL. In addition, a documented report is available as part of the code package. Both code centers will be provided modifications and additions to the basic package.
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