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Computer Code Abstracts*

ABSTRACT No. 14

1. Name of code: HAFEVER
2. Computer for which code is designed: IBM 704
   Programming system: FORTRAN II
3. Nature of problem solved: Calculation of the energy exchange inelastic scattering cross section (integrated over angle) according to the Hauser-Feshbach theory as modified by D. Goldman. This modification includes the effect of spin-orbit coupling on the transmission coefficients.
4. Restrictions on the complexity of the problem:
   Maximum number of energy levels of target nucleus—20
   Target nucleus originally in ground state
   Maximum neutron orbital angular momentum, $l = 14$
   Machine requirements: 8K 704 with 2 drum units and 8 tape units.
5. Typical running time: 5–15 sec
6. Unusual features of the code: This program is one of two similar codes written for the IBM 704. The other code, developed by M. Gursky of Los Alamos Scientific Laboratory, requires at least a 16K machine but has the advantage of giving the angular distribution if this is considered necessary. A code which performs similar types of calculation has also been prepared by M. Kalos and E. Troubetzkoy of NDA for the Datatron 205. Input penetrabilities may be obtained from the SWAMI code (KAPL) or by any other desired methods. The subject code is also part of the ABACUS system developed at KAPL which includes SWAMI, HAFEVER, and an optical parameter search.
7. Present status: At present in use under the General Motors Master Control System (their "F" system). A general form of the code (with slightly modified input/output) that will operate off this system was compiled at Brookhaven National Laboratory and is also available.
8. *References:*

M. H. Kalos and E. S. Troubetzkoy, A description of the Sortie I code. NDA Phys. 1349.

E. D. Reilly, SWAMI, a nuclear optical model code for the IBM-704. KAPL (internal memorandum) (December 7, 1959).

E. H. Auerbach, ABACUS 1—preliminary description and input preparation. KAPL-M-EHA-1 Physics and Mathematics (December 15, 1960).

M. A. Friedman and P. F. Zweifel, HAFEVER—an inelastic scattering code for the IBM-704. APDA-141 (September, 1960).

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ABSTRACT No. 15

1. Name of code: APWRC-SYNFAR
2. Computer for which code is designed: IBM 709
   Programming system: FORTRAN II including FAP
3. Nature of problem solved: Synthesis computation of the static flux and reactivity, or of the stable period and corresponding flux shape, in XY or RZ geometry. Direct computation of the same quantities in one-dimensional spherical geometry.
4. Method of solution: It is assumed, in two-dimensional problems, that the flux is separable in the two perpendicular directions. One-dimensional calculations are carried out alternately in each direction, and are coupled through lethargy dependent bucklings. This process is repeated until eigenvalues in both directions agree to within a prescribed convergence criterion. The spatial calculations are based on a few-group model. Few-group constants are prepared internally by a "Moderation Calculation" routine which computes a flux spectrum in the presence of a prescribed buckling. Spatial calculations are either $P1$ or Sn.
5. Restrictions on the complexity of the problem:
   Moderation calculations
   20 lethargy levels; temperature 68–2980°F.
   Modified Age or Coveyou-Macauley theory (4).
   Spectral hardening based on T-eff $= T_0(1 + 0.75\ \Sigma_a/\xi\Sigma_s)^2$.
   Transport equations
   2 or 3 groups
   $P1$, $S2$, $S4$, $S6$, $S8$, $S16$; no $S16$ for cylinder direction
   199 space intervals/direction
   25 material regions/direction
   50 averaging regions/direction
   Machine requirements: 32K memory, ten tape units; card reader not needed.
6. Typical running time: 12 min for 3 passes on right circular cylinder with homogeneous core and reflector (Core No. 2 of WAPD-TM-244) using C groups, $P1$ radially, $S16$ axially, 70 intervals in each direction; $P1$ convergence in K-eff of 0.0001, $S16$ convergence in K-eff of 0.001, axial-radial convergence in K-eff of 0.002. K-eff = 0.992.
7. Unusual features: The dynamic calculation yields the inverse stable period, as well as K-dynamic, the K-instantaneous neutron lifetime and the effective delay fraction. $P1$ and/or Sn synthesis. $P1$ or Sn adjoint com-

* Computer codes for this section should be submitted directly to the *Code Abstract Editor*, Ely M. Gelbard, Bettis Atomic Power Laboratory, Westinghouse Electric Corporation, P. O. Box 1468, Pittsburg 30, Pennsylvania.