FLEER

1. Name of program: FLEER
2. Computer for which the program is designed: 32K IBM-704 with seven tape units and four logical drums *or* 32K Philco-2000 with fourteen tape units.
3. Nature of the problem solved: Two-dimensional diffusion equation in uniform triangular mesh geometry.
4. Method of solution: Because of the necessity of treating a special 120° periodic boundary condition, the inner or flux iteration is accomplished by accelerated Liebmann "bent" line relaxation. The outer boundary of a problem must be a rhombus located in the first quadrant of a coordinate system whose axes are inclined at 120°. The path of iterating any given line starts on the top of the rhombus and ends on the right hand side, bending on the main diagonal.
5. Restrictions on the complexity of the problems solved:

	IBM-704	Philco-2000
a. Number of groups	3	$\leqq 5$
b. Number of mesh points	14000	20000
c. Number of material regions	250	511

6. Typical running time. Without a good source guess, three group, 200 region problems take about 40 min per 1000 points on the IBM-704 and about 12 min per 1000 points on the Philco-2000. On either machine, the use of a good source guess from a similar problem will cut the time by 25 to 50%.
7. Unusual features: Both versions allow a special 120° periodic boundary condition to be applied to the left and bottom sides of a problem. The Philco-2000 version allows a doubly periodic boundary condition, i.e., 120° periodicity on top and right as well as left and bottom. The IBM-704 version cannot be depleted, but Philco-2000 FLEER is actually a part of the KARE System and thus shares all depletion, perturbation, and flux synthesis capabilities of that system. (See accompanying abstract.)
8. Present status: Both versions have been used extensively at KAPL; current usage is all on the Philco-2000. For further information, contact, J. L. Fletcher. Copies of the 704 version are available from the SHARE Secretary, Mr. Donald C. Cashman, SHARE Distribution Agency, 590 Madison Avenue, New York 22, New York. Copies of the Philco-2000 version are available from the TUG (Transac User Group) Executive Secretary, Mr. John C. W. Cadoo, Jr., Philco Corporation, 3900 Welsh Road, Willow Grove, Pennsylvania.
9. *References:* J. L. Fletcher, J. P. Jewett, and E. D. Reilly, Jr., FLEER: A two-dimensional triangular-mesh diffusion program for the IBM-704. KAPL-2086 (May 6, 1960). Also, see references under KARE.

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TRAM

1. Name of program: TRAM
2. Computer for which the program is designed: 32K Philco-2000 with seven tape units.
3. Nature of the problem solved: TRAM is a two- or three-dimensional neutron transport program for the Monte Carlo determination of spatial and spectral variations of the neutron population below 100 ev in hydrogen moderated assemblies. The computations are carried out by a nonbranching Monte Carlo method in which the principal random variables are obtained by a high-speed random address technique.
4. Method of solution: The input requirements of TRAM include a list of either number densities or masses and volumes for the elements of each material used in the problem. From this list, TRAM prepares tables of mean free paths and conditional probabilities for the collision processes for each of 32 energy groups. A one-group option may also be used.
   Source particles are automatically generated with a uniform distribution inside each source region and with a region dependent source rate specified as input. The source energy is stochastically determined by assuming that the particle has just been scattered by hydrogen with an incident energy of 100 ev.
   All elements except hydrogen scatter isotropically in the laboratory system without energy exchange. Five types of hydrogen scattering are used in various proportions in the 32 groups to provide a model for proton thermal motion and chemical binding which gives infinite medium spectra and diffusion lengths in agreement with measured values.
5. Restrictions on the complexity of the problem:
   a. Number of material regions $\leqq 100$
   b. Number of zones $\leqq 200$
   c. Number of surfaces $\leqq 200$
   d. Maximum source energy 100 ev
6. Typical running time: Thirty minutes to an hour or more depending on the complexity of the problem.
7. Unusual features: Geometrically, a TRAM problem is composed of up to 200 zones which may contain up to 100 different types of materials. Zones are bounded by surfaces (up to 200 are allowed) which may be either linear or sections of elliptic cylinders with axes parallel to the z-axis. Each surface may be designated as reflecting, transmitting, or trapping (incident particles are absorbed, counted in special trap registers, and removed from the game).
   Each TRAM problem consists of 25 repetitions, with different random numbers, of the same basic experiment, each run with the same number of particle histories. A final statistical edit will print estimates with confidence limits of the path-length accumulations and capture rates in each spatial zone of the problem. A special tracing mode allows the paths of individual particles to be followed in detail; this option is especially useful if difficulty is encountered in running a particular problem.
8. Present status: In production at KAPL. For further information, contact R. A. Pfeiffer. Copies of the program and of the report referenced below are available from the TUG Executive Secretary, Mr. John C. W. Cadoo, Jr., Philco Corporation, 3900 Welsh Road, Willow Grove, Pennsylvania.