Computer Code Abstract

NØAH

1. Name of Code: NØAH

2. Computer for Which Code is designed: CDC-6600, Program Language: FORTRAN IV

3. Nature of Physical Problem Solved: NØAH solves the one dimensional, one group space-time diffusion equation accounting for the effects of fuel, clad, and coolant temperatures (or by changing subroutines fuel, coolant, and solid moderator temperatures) on fission and absorption cross sections, and on the diffusion coefficient and the transverse buckling. It accounts, if desired, for the effects of xenon-iodine feedback. If desired it will determine long-time xenon-flux behavior assuming the temperatures to be in quasi-static equilibrium. Numerous methods of perturbation are allowed and control of the transient is also allowed for. Up to six groups of delayed neutrons can be handled.

4. Method of Solution: The equilibrium state is determined iteratively by an implicit two pass technique. Three acceleration methods are available: first and second order extrapolation of the source and a jump extrapolation every thirteen iterations. Pointwise flux convergence is required. The transient is solved by backwards differencing of time derivatives, and coefficients are evaluated at the preceeding time step. All dependent variables (including temperatures and xenon) are evaluated on the same spatial mesh. Five output procedures are possible.

5. Restrictions on Complexity: Ten regions and 500 space points are allowed for. A new region is required when the feedback free value of any of the parameters are changed from the preceeding region values.

6. Typical Running Time: If NS is the number of space points and NT the number of time steps (one steady state iteration is equivalent to one time step), then the running time is $T = NS*NT/1500$ sec. For pointwise convergence to 10^{-6} the equilibrium state is typically obtained in 20 to 80 iterations depending on the choice of acceleration parameters.

7. Unusual Features of the Program: The equilibrium is solved by adding a pseudo time derivative with a relatively small time constant. The approach to equilibrium is rapid because the pseudo time eigenvalue is large. The jump extrapolation technique tends to further increase the rate of approach to equilibrium. Provision for reading in an already calculated equilibrium state (or an arbitrary initial flux and temperature distribution) is allowed for. Restart is allowed for. Provision is made for additions to the program by the user (by this we mean a number of input locations are not used in the current configuration but are addressable, hence, may be used in user initiated subroutines without changing the dimension statements).

8. Status: A descriptive and operating manual BNL 50157 (T-523) is in press and the program is in routine use. When the manual is published the program will be sent to the Argonne Code Center.

9. Machine Requirements: The program was written for a CDC-6600 with a central memory of 64K. (The code itself occupies less than 27K locations.)

10. Operating System: The program was constructed within the Scope 3 system but will also operate within Scope 2.

11. *Reference:*

[1]G. S. LELLOUCHE, "NØAH, A Code for Solving the One Dimensional Space-Time Diffusion Equation Accounting for the Effects of Temperature and Xenon Feedback," BNL 50157 (T-153) in press.

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