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Brief 71-10037

AEC-NASA TECH BRIEF

Space Nuclear Systems Office

Computer Program for Predicting Creep Behavior of Bodies of Revolution

The problem:

To predict the creep strains and steady-state stresses in an arbitrary body of revolution subjected to a time-dependent axisymmetric load. The creep strains are assumed to follow a time hardening law, and a Prandtl-Reuss stress-strain relationship.

The solution:

A computer program called CRAB, which uses the finite-element method to calculate the creep behavior of bodies of revolution.

How it's done:

The body is modeled by a system of discrete, triangular-cross-section, circular-ring elements interconnected along circumferential nodal circles. The equations of equilibrium for the body are derived from the principle of minimum potential energy. The creep behavior of the body is obtained by use of an incremental approach. The method involves starting with the elastic solution of the problem (i.e., at time equal to zero) and calculating the creep strains for a small time increment. These creep strains are treated as initial strains to determine the new stress distribution at the end of the time increment. The procedure is repeated until either the final time is reached or the stress distribution is not changed (i.e., a steady-state condition is reached). Once a steady-state condition is encountered, the program extrapolates the creep strains either to the final time or to the time at which the loading is to be changed. For the latter case, the additional stresses caused by the load increment are calculated and the creep solution technique is again repeated.

The program can solve problems which require up to 360 nodal points and 525 elements to model the structure. The time increments at which the creep solution is obtained are automatically calculated within the program. Displacements, stresses, and creep strains are computed for every time step; however, the user has the option of specifying at which time steps the output data are to be printed.

Notes:

1. This program is written in FORTRAN IV for use on the CDC 6600 computer.
2. The program would be useful to designers and industrial users of pressure vessels.
3. Inquiries should be made to:

   COSMIC
   Barrow Hall
   University of Georgia
   Athens, Georgia 30601
   Reference: B71-10037

Patent status:

No patent action is contemplated by AEC or NASA.

Source: G. Greenbaum and R. Adams of
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Category 09