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Brief 71-10398

NASA TECH BRIEF

Lewis Research Center

Steady Temperature and Density Distributions in a Gas Containing Heat Sources

A digital computer program, STADDIG, calculates axial temperature and density distributions in a stagnant gas containing heat sources and contained within an annulus. In a nuclear reactor, when a neutron-absorbing gas is exposed to a neutron flux, the spatial distribution of the mass of gas (gas density) must be known because of its influence on the spatial distribution of neutrons and the resulting effects on reactor criticality.

The program is based on a steady-state, one-dimensional (radial) heat-transfer calculation using cylindrical coordinates. The gas density is related to the gas temperature through the perfect gas law. The program allows for conduction across the gas and across the container walls. Heat is dissipated from the container walls by forced-convection cooling with an incompressible coolant. Heat sources are included in the coolant, the gas, and the container walls.

The axial distribution of gas temperature and density is determined by successive radial heat-transfer calculations at different axial positions. Axial heat conduction is neglected. A typical problem containing 20 axial increments requires about 4 seconds of running time when the gas densities and thermal conductivities are required to converge within 0.1 and 1%, respectively. Changing the convergence requirements has no appreciable influence on the problem running time.

Notes:

1. This program is written in FORTRAN IV for use on the IBM-7094 computer.
2. Requests for further information may be directed to:

   COSMIC
   112 Barrow Hall
   University of Georgia
   Athens, Georgia 30601
   Reference: B71-10398

Patent status:

No patent action is contemplated by NASA.

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