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NASA TECH BRIEF

Lyndon B. Johnson Space Center

Multiple-Compartment Venting Program

The problem:

In a system of gas reservoirs connected by orifices and pipes, it is important to be able to predict the pressure history of various reservoirs, the pressure differential between reservoirs, and the mass flow rate through the conductors connecting these reservoirs.

The solution:

The pressure in a gas reservoir is dependent on the state properties of the gas and the net mass rate entering or leaving the compartment. The mass flux leaving or entering a reservoir is a function of the type and size of the conductor connected to the reservoir and the pressure differential across the conductor. The change in mass and pressure within the reservoir also results in a change in the state properties of density and temperature. A computer program has been written which solves the time-dependent venting equations for an arbitrary number of compartments interconnected by any number of orifices and/or pipes.

How it's done:

This computer program solves the time-dependent energy and state equations for the gas reservoirs, using the solutions of the conductor conservation equations as mass and energy rate changes to the reservoirs. However, for the solutions of the conductor conservation equations, the reservoir conditions are used as boundary conditions. This coupling of the boundary conditions and the reservoir/conductor conditions is handled within the program by analyzing each conductor separately, and assuming quiescent conditions in the connected reservoirs, and by calculating a steady-state flow condition in the conductor. The assumption of the quiescent conditions within the reservoir is realistic whenever small time-integration steps are taken. Thus, for each conductor analyzed, a free system of two reservoirs and the conductor is used, and the appropriate set of equations is applied.

Notes:

1. This program was written in FORTRAN IV for the IBM 360-series computers.
2. Inquiries concerning this program should be directed to:
   COSMIC
   112 Barrow Hall
   University of Georgia
   Athens, Georgia 30601
   Reference: MSC-19428

Source: L. P. LeBlanc of
Rockwell International Corp.
(MSC-19428)

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