AEC-NASA TECH BRIEF

Computer Program MCAP–TOSS Calculates Steady-State Fluid Dynamics of Coolant in Parallel Channels and Temperature Distribution in Surrounding Heat-Generating Solid

The problem:

To develop a computer program to handle the calculation of the steady state fluid distribution, temperature rise, and pressure drop of a coolant and the material temperature distribution of a heat generating solid, as well as the heat flux distributions at the fluid–solid interfaces. The system to be analyzed is a parallel multiple channel flow system separated by heat conducting solids of arbitrary geometry. The previous method required manual iterations between two analyses at a substantial cost in manpower and time.

The solution:

A program which performs the necessary iterations automatically within the computer, in one machine run. The fluid flow and heat conduction calculations of two independent codes (MCAP and TOSS) are coupled together to form a complete program.

How it's done:

The computer program solves simultaneously the steady-state fluid flow and heat transfer analysis of a heat generating solid cooled by fluid flowing in parallel channels. The composite solution provides the fluid-flow distribution, temperature rise, and total pressure loss of the coolant, as well as the temperature distribution within the solid and the distribution of heat flux along the channel walls. The program can handle any of six different solid materials, various single-phase fluids, and up to 30 parallel channels having common inlet and outlet plenums. The heat conduction routine has provision for 2 or 3 dimensional analysis; the fluid flow is one-dimensional with wall friction and heat addition normal to flow direction.

The iterative calculations are performed in one machine run. The fluid flow and heat conduction routines are two independent codes, but are coupled to form a composite program.

Notes:

1. The program is written in a modified version of Fortran II language for use on the IBM 7094 computer.

2. This program can be used by numerous industries in many heat transfer applications involving the use of gaseous coolants in a multichannel heat transfer system.

3. Inquiries concerning this program may be directed to:

   COSMIC
   Computer Center
   University of Georgia
   Athens, Georgia 30601
   Reference: B67-10456

Patent status:

No patent action is contemplated by AEC or NASA.

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