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Brief 67-10495

NASA TECH BRIEF

Multidimensional Reaction Kinetic Ablation Program (REKAP)

The problem:

A multidimensional reaction kinetics ablation program was needed to provide an improved capability for analyzing thermal performance of partially penetrated charring ablator heat shields. The existing one-dimensional REKAP program did not include multilayer internal decomposition and multidimensional transient heat conduction.

The solution:

The program was provided with the following surface recession options: no melting or surface recession, graphite sublimation, and fixed melting or vaporization temperature. The mass loss rate of each element of material was assumed to be controlled by an Arrhenius type of equation. The capability was provided for determining transient temperature histories in an ablating three-dimensional shape consisting of up to five layers of material.

How it's done:

The method of solution employed in the Multidimensional REKAP Program consists of the formulation of an orthogonal curvilinear coordinate system which approximately coincides with the geometric description of the penetrated heat shield. The charring ablation equations are then solved in this curvilinear coordinate system by a finite difference technique. Three types of idealized partial penetrations are approximated by suitable analytical functions: cylinder, core, and double ellipsoid. The program was calibrated by comparing computed results with test data for unpenetrated and partially penetrated specimens of rigid ablative material.

Notes:

1. This program is written in Fortran IV for use on an IBM 7094 computer.
2. The generalized nature of the program will permit its application to any surface geometry for which analytical approximations can be written.
3. Inquiries concerning this program may be made to:

   COSMIC
   Computer Center
   University of Georgia
   Athens, Georgia 30601
   Reference: B67-10495

Patent status:

No patent action is contemplated by NASA.

Source: E. Binck, B. Collingswood and B. Aston
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Category 06