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Brief 71-10372

NASA TECH BRIEF

Lewis Research Center

Analysis of Multilayered Fiber Composites

The problem:

To develop a multilevel analysis program for designing structural components with multilayered fiber composites.

The solution:

A multilevel analysis computer program which efficiently predicts the structural response of multilayered fiber composites.

How it's done:

The multilevel analysis consists of (1) micromechanics theories for the single ply thermoelastic properties and stress-limit as functions of constituent materials properties and the particular fabrication process, (2) the combined stress-strength criterion of the single ply, and (3) the multilayered composite structural response and analysis, where the interply layer effects are taken into account.

The inputs to the program are constituent materials properties, factors representing the fabrication process, and composite geometry. The program performs the micromechanics, macromechanics, and laminate analysis of fiber composites. The outputs are the various ply and composite properties, the composite structural response (accounting for bending stretching, coupling etc.), and the composite stress analysis results, including the results of the combined stress-strength criteria. The program can be used efficiently as a package in complex-structure analyses, finite-element methods, buckling and vibration studies, and structural syntheses. Sample trial cases are included to aid in the use of this program.

The program has been used successfully in the analysis of various fiber matrix multilayered composites. It has proved to be efficient in structural syntheses of multilayered thornel/epoxy composite plates, in buckling studies of simply supported multilayered fiber-composite plates, and in computing the lamination residual stresses in angle ply composites. The program documentation includes the mechanics of using the program and the equations used in the program. Correlation coefficients for new composite systems are described, and possible extensions for temperature-dependent properties, material nonlinearities and failure load envelopes are included.

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: B71-10372

Patent status:

No patent action is contemplated by NASA.

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(LEW-11347)

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