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Automatic Data Generation Scheme for Finite-Element Method (FEDGE): Computer Program

The problem:

To devise a versatile and general purpose tool for input data preparation for the analysis of continuous domains in the fields of structural analysis, heat transfer, or fluid mechanics. In the past, considerable attention has been given to automating the performance of such an analysis, but not to automating the preparation of input data.

The solution:

The algorithm used in the program is based on a suitable classification of the topological properties of complex geometrical configurations in one-, two-, or three-dimensional space. The algorithm provides for an automatic means of making continuous domains of any form discrete by using the concept of natural coordinate systems.

Depending on the complexity of the geometrical form and the diversity of the field quantities associated with different regions in the domain considered or on its boundary, the solution domain is divided into subdomains. Each subdomain has homogeneous field properties and reasonably convex form. The field quantities and geometrical properties associated with each region and the connectivity information of the adjacent subdomains are provided by the user as input. The generation of the mesh, computations of nodal coordinates, and the distribution of field properties to each finite element are automatically performed.

The FEDGE program can be used for generation of input data for almost any structural analysis program using the finite-element method such as the SAMIS (Structural Analysis and Matrix Interpretive System) and ELAS (Equilibrium Problems of Linear Structures) programs, and also for data generation for solution of problems in other fields such as heat trans-

fer or fluid mechanics in which the finite-element technique is useful. FEDGE can also be used to generate input data for the solution of engineering and physics problems in which the finite-difference technique is used. As a general applicability rule, the natural coordinate system concept and the associated FEDGE program can be utilized for data generation in any field in which description of a domain with known boundary is required, especially where there is need for repeated use of such description.

Notes:

1. This program is written in FORTRAN II (97%) and FAP (3%). The program was developed for the 32K IBM 7094/44 DCS; however, it may be used in other systems that have the FORTRAN II compiler and FAP assembler. The program requires 10 1/0 units.
2. The SAMIS and ELAS programs are summarized in Tech Briefs 69-10093 and 68-10187, respectively.
3. Inquiries concerning these programs should be directed to:

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Patent status:

No patent action is contemplated by NASA.

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