

# NASA TECH BRIEF

## *Lyndon B. Johnson Space Center*



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### **The Static Nonlinear Analysis of Shells of Revolution (SNASOR II)**

#### **The problem:**

A nonlinear analysis of shells of revolution that are not in motion was needed.

#### **The solution:**

A computer program, the static nonlinear analysis of shells of revolution subjected to arbitrary mechanical and thermal loading, has been developed to solve this problem.

#### **How it's done:**

Utilizing stiffness matrices generated by SAMMSOR (NASA Tech Brief B73-10445) and supplying as input the loading and boundary conditions, SNASOR II generates the equilibrium equations for the structure. The nonlinear strain energy terms result in pseudo-generalized forces (as functions of the displacements) which are combined with the applied generalized forces. The resulting set of nonlinear algebraic equilibrium equations is solved by one of several methods: Newton-Raphson type iteration, the incremental stiffness method, and a modified incremental stiffness method. In general, the Newton-Raphson procedure is the best and yields accurate results for highly nonlinear problems with a

reasonable expenditure of computer time. Symmetrical and asymmetrical large deflection problems have been solved using this code. Buckling loads for symmetrically and asymmetrically loaded shells (with moderately large prebuckling deflection) have been obtained and checked with other solutions.

#### **Notes:**

1. This program was written in FORTRAN IV for the IBM 360 or CDC 6000 series computers.
2. Inquiries concerning this problem should be directed to:

COSMIC  
112 Barrow Hall  
University of Georgia  
Athens, Georgia 30602  
Reference: MSC-14495

Source: J. A. Stricklin and W. E. Haisler of  
Texas A&M University  
under contract to  
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