IUTAM INTERNATIONAL UNION OF THEORETICAL AND APPLIED MECHANICS

18th ICTAM 1992
HAIFA - ISRAEL

XVIIIth INTERNATIONAL CONGRESS OF THEORETICAL AND APPLIED MECHANICS

HAIFA, ISRAEL, AUGUST 22-28, 1992

TECHNION - ISRAEL INSTITUTE OF TECHNOLOGY

ABSTRACTS

Rizzi, N., Ruta, G., Tatone, A.
THE INFLUENCE OF WARPING ON THE POSTBUCKLING BEHAVIOR OF THIN-WALLED BEAMS WITH OPEN CROSS-SECTION (#927)

In previous work, some writers discussed the modeling of thin-walled beams, in a direct way, as one dimensional continua endowed with local structure developing a theory in finite elasticity with: a) an exact description of the beam kinematics; b) the balance equations written with reference to a generic configuration; c) the derivation of a power formula; d) use of frame indifference to obtain reduced constitutive relations.

In the present work, based on the cited theory, the postbuckling behavior of straight beams clamped at one end and free at the other is investigated. Both the cases in which the warping is free or restrained at the clamped end are considered. The beam sections are supposed to have one axis of symmetry.

The following 'dead' load conditions at the free end are examined: a) an axial force applied at the centroid; b) a flexural couple acting on a central inertia axis; c) a shear force acting on a central inertia axis.

Most of the results obtained, and in particular those concerning the non-linear analysis, are new. When possible they are also compared with those obtained by the authors.

Rodin, G.J.
CONTINUUM DAMAGE MECHANICS OF CONSTRAINED INTERGRANULAR CAVITATION (#492)

A three-dimensional micromechanical model for polycrystalline materials under-going constrained intergranular cavitation is proposed. The model combines the simplicity of continuum damage mechanics with the sophistication of micromechanical theories, and can be calibrated from standard uniaxial creep data.

The novel element of the model is the evolutionary equation for a physically defined damage variable. This equation is derived using well-established phenomenological and metallurgical observations. Required micromechanical calculations are based on the finite element analysis of the three-dimensional periodic array of truncated octahedra.

The model successfully predicts the creep life of multiaxial laboratory specimens made of six commercial alloys. The model is employed in a study of damage propagation in non-uniformly stressed specimens. Also, the amount of damage in uniaxial tension specimens agrees reasonably well with that observed experimentally.

Rogovoy, A.A.
CONSTITUTIVE EQUATIONS WITH FINITE DEFORMATIONS (#1037)

The relations between different forms of the stress tensor and the corotational derivatives are established that allows with the help of the objectivity principle to select the unique corotational derivative consistent with the stress tensor to be used in the state equation.

Different forms of the constitutive equations relative to the reference configuration with initial Cauchy stresses are considered for a simple material including the cases of superposition of a small deformation on a finite one and vice versa. The analysis is made for the two special cases of the gradient deformation decomposition into small and finite parts when the tensor of small deformations does not change the stress state.

These results have been used to obtain the constitutive equations for the large elasto-plastic deformations with any state equation for the elasticity and Prandtl-Reiss relation for the plasticity within the framework of the Lee gradient deformation decomposition into elastic and plastic parts. A particular form of these equations is derived for the simplified elastic Signorini law which in the case of small elastic deformations leads to the well-known relation.

Rong, T.-Y.
THEORY AND METHOD OF STRUCTURAL VARIATIONS OF FINITE ELEMENT SYSTEMS IN SOLID MECHANICS (#17)

This paper is the continuation of the author's previous work (General Theorems of Topological Variations of Elastic Structures and the Method of Structural Topological Variation, *Acta Mechanica Solida Sinica*, Vol. 6, No. 1, 1985, 29-43, P.R. China), extending the *Theory of Structural Variations* presented therein from skeletal structures to finite element systems in solid mechanics. Based on this theory a fresh analysis tool, which is totally eliminating the need of formulating and solving simultaneous equations (global stiffness matrix equations) as required in the Commonly used FEM, is developed and named the *Structural Variation*