Professor Emeritus Nai-Chien Huang (1933 – 2012)

Deparment of Aerospace and Mechanical Engineering
University of Notre Dame

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http://today.nd.edu/news/28414-in-memoriam-nai-chien-huang-professor-emeritus-of-aerospace-and-mechanical-engineering/

From Today@ND, January 18, 2012, by Michael O. Garvey:

Nai-Chien Huang, professor emeritus of aerospace and mechanical engineering at the University of Notre Dame, died Sunday (Jan. 15) at his home in Los Altos, Calif., after a long illness. He was 79 years old.

A native of Nantong, China, Huang studied engineering at National Taiwan University in Tapei and was graduated in 1953. He earned master's and doctoral degrees from Brown University and Harvard in 1958 and 1963, respectively. Before joining the Notre Dame faculty in 1983, he served on the faculties of the University of California at San Diego, Stanford University, the Massachusetts Institute of Technology and the University of Wisconsin. He retired in 2001.

"N.C. was simply a wonderful man who epitomized that expression 'a gentleman and a scholar,'" according to his colleague and friend Joseph Powers, professor of aerospace and mechanical engineering. "He was a great teacher, always impeccable in his presentation and with a conspicuous reverence for knowledge. He loved Notre Dame, its students and faculty, and he was a great role model…including for me."

Selected Publications about Shells:

Huang, N.C., "Unsymmetrical Buckling of Thin Shallow Spherical Shells," J. of Applied Mechanics, 31, 1964, pp. 447-457.
DTIC Accession Number: AD0409599, Handle / proxy Url : http://handle.dtic.mil/100.2/AD409599
ABSTRACT: A theoretical study of buckling of clamped shallow spherical shells under uniform external pressure is presented. For sufficiently large deflection, deformations of such shells are not proportional to the applied pressure. The shell deforms axisymmetrically under sufficiently low pressure. The problem of axisymmetrical snapping has been solved by different numerical methods and the results agree with each other. The buck ling pressures obtained in such a manner are too high as compared with experimental results ob tained in References. Initial imperfections of the shell and unsymmetrical buckling are presumed to be the sources of this discrepancy between axisymmetrical buckling theory and experiment.

Huang, N.C. Axisymmetric dynamic snap-through of elastic clamped shallow spherical shells. A.I.A.A. J. 7 (2), (1969)215-220.

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"Fracture mechanics of plates and shells applied to fail-safe analysis of fuselage Part I: Theory", Theoretical and Applied Fracture Mechanics, Vol 27, No. 3, August 1997, pp. 221-236,
doi:10.1016/S0167-8442(97)00024-4
ABSTRACT: In this paper, a general theory on the asymptotic field near the crack tip for plates and shells with and without shear deformation effect is established. It is found that four stress intensity factors, two for symmetrical and antisymmetrical stretching and two for symmetrical and antisymmetrical bending, are required to describe arbitrary asymptotic fields near the crack tip for plates without shear deformation. An additional stress intensity factor is required for the transverse shearing force induced by antisymmetrical bending when the shear deformation is included in the analysis. It is also proven by means of the complex variable technique that for problems of plates with shear deformation, there exist similarities in the asymptotic expressions of moments and membrane forces and also in the asymptotic expressions of in-plane displacements and rotations of the mid-surface. The energy release rate associated with crack growth in the direction of the crack line can be expressed in terms of stress intensity factors by means of Irwin's method of work and energy associated with a virtual crack extension. A combined stress intensity factor can be defined through the total energy release rate. The theory of the fracture of plates is generalized and applied to the study of problems in the fracture of shells. An example of an infinitely long cylindrical shell with a circumferential crack subjected to remote axial tension is given to demonstrate the application of the theory and to test the accuracy of the numerical analysis used for the problem.

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“Fracture mechanics of plates and shells applied to fail-safe analysis of fuselage Part II: Computational results”, Theoretical and Applied Fracture Mechanics, Vol. 27, No. 3, August 1997, pp. 237-253, doi:10.1016/S0167-8442(97)00025-6
ABSTRACT: In this paper, the problem of the fracture of a fuselage stiffened by longitudinal longerons and circumferential frames is analyzed by means of the finite element method. Our research is motivated by the fail-safety design concept of fuselage for civil aircraft. In this study, the total energy release rate are evaluated for five types of basic loading, namely, axial extension, pure bending, twisting, transverse shearing, and radial expansion due to internal pressure. The crack is located either at the mid-point or near the end of the fuselage. It extends in two bays with the stiffener at its center. The stiffener which bisects the crack is assumed to be broken at the location of the crack. Computational results indicate that the total energy release rate Gt increases with the increasing crack length. However, when the crack tip approaches the stiffener, the value of Gt decreases as a result of the reinforcement from the stiffener. For a crack near the end of the fuselage, as a result of boundary effect, the value of Gt is larger in comparison with the case of the crack at the mid-point of the fuselage. We also find that the effect of geometrical nonlinearity can reduce the value of Gt for the fuselage under axial tension or pure bending. For the fractured fuselage under pure bending, shell buckling can occur at the concave side of the fuselage prior to crack growth. The maximum tensile stress in the stiffener in front of the crack tip is also investigated.