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Selected Publications:

J.G. Williams and R.C. Davis (NASA Langley Research Center, Hampton, Virginia, USA), “Experiments on stiffened conical shell structures using cast epoxy models”, Society for Experimental Stress Analysis, Fall Meeting, Indianapolis, Ind ; United States; 16-19 Oct. 1973. 38 pp. 1973

ABSTRACT: Description of a casting technique for fabricating high-quality plastic structural models, and review of results regarding the use of such specimens to parametrically study the effect of base ring stiffness on the critical buckling pressure of a ring-stiffened conical shell. The fabrication technique involves machining a metal mold to the desired configuration and vacuum-drawing the plastic material into the mold. A room-temperature curing translucent thermoset epoxy was the casting material selected. A shell of revolution computer program which employs a nonlinear axisymmetric prebuckling strain field to obtain a bifurcation buckling solution was used to guide the selection of congifurations tested. The shell experimentally exhibited asymmetric collapse behavior, and the ultimate load was considerably higher than the analytical bifurcation prediction. The asymmetric buckling mode shape, however, initially appeared at a pressure near the analysis bifurcation solution.

Ewing PD and Williams JG (1974), Fracture of spherical-shells under pressure and circular tubes with angled cracks in torsion, International Journal of Fracture 10, 537–544.

J. G. Williams and R. C. Davis, "Buckling experiments on stiffened cast-epoxy conical shells
A casting technique for manufacturing high-quality shell specimens with complex geometry is described and experimental and theoretical results are presented for a pressure-loaded ring-stiffened conical shell", Experimental Mechanics, Vol. 15, No. 9, 1975, pp. 329-338, DOI: 10.1007/BF02318873
ABSTRACT: This paper describes a casting technique for fabricating high-quality plastic structural models and presents results on the use of such specimens to parametrically study the effect of base-ring stiffness on the critical buckling pressure of a ring-stiffened conical shell. The fabrication technique involves machining a metal mold to the desired configuration and vacuum drawing the plastic material into the mold. A room-temperature-curing translucent thermoset epoxy was the casting material selected. The casting technique allows many high-quality specimens to be produced and each specimen is capable of being repeatedly tested without failure. The conical shell was modified for successive tests by machining the epoxy base-ring configuration to reduce its stiffness. A shell-of-revolution computer program which uses a nonlinear axisymmetric prebuckling strain field to obtain a bifurcation-buckling solution was used to guide the selection of configurations tested. The shell experimentally exhibited asymmetric collapse behavior and the ultimate load was considerably higher than the analyticalbifurcation prediction. The asymmetric buckling-mode shape, however, initially appeared at a pressure near the analysis-bifurcation solution. Comparison of experimental and analytical prebuckling strains at pressure magnitudes below the initiation of asymmetric collapse showed good agreement.

Williams, J. G. and Mikulas, Jr., M. M., Analytical and Experimental Study of Structurally Efficient Composite Hat-Stiffened Panels Loaded in Axial Compression, AIAA/ASME/SAE 16th SDM Meeting, Denver, Colorado, May 1975.
Almroth's comments: Tests were conducted on a number of hat-stiffened graphite-epoxy panels. The panel dimensions correspond to optimum weight configurations. A number of panels (23) of length 16 in. were critical in local buckling. In the experiments local buckling was observed by use of the Moire pattern and by the observation of strain reversal. These two methods agree with one another but the agreement with theory (BUCLASP) is not good. This is assumed to be due to large deviations from nominal thicknesses and to local initial stresses due to the curing process. The experiments were continued to ultimate failure which typically occurred at about 25% above the experimental buckling load. The authors conclude that "buckled skin concepts" might be possible (but that), the brittle nature of graphite-epoxy composites makes their practicality highly speculative at this time. In addition, six longer panels (60 in.) were tested. These were critical in Euler buckling. The test results in these cases fall between 64 and 90 percent of the critical load. This disagreement appears to be the result of transverse shear effects. The disagreement between experiment and theory reduces

a potential 50% weight saving (in comparison to aluminum) to a 32% saving. This estimate does not account for the use of buckled skin concepts for aluminum panels.

Williams, J. G. and Stein, M., “Buckling Behavior and Structural Efficiency of Open-Section Stiffened Composite Compression Panels,” AIAA Journal, Vol. 14, No. 11, 1976, pp. 1618–1626.

Arbocz, J. and Williams, J. G., "Imperfection Surveys on a 10-ft-Diameter Shell Structure," AIAA Journal, Vol. 15, 1977, pp. 949-956.
ABSTRACT: The results of an extensive imperfection survey on a 10-ft-diameter integrally stiffened cylindrical shell are presented. The shape of the measured initial imperfections is clearly influenced by details of the shell construction. The modal components of the measured imperfection surface as a function of the circumferential and of the axial wave numbers are calculated. The discrete axial power spectral density functions and the corresponding root-mean-square values of the imperfections are also determined for given circumferential wave numbers. Using the Fourier coefficients of the measured initial imperfections, buckling loads are calculated by solving the nonlinear Donnell-type imperfect shell equations iteratively. The calculated lowest buckling load compares favorably with the values usually recommended for similar shell structures.

Williams, J. G., Anderson, M. S., Rhodes, M. D., Starnes, J. H., Jr., and Stroud, W. J.: Recent Developments in the Design, Testing, and Impact-Damage Tolerance of Stiffened Composite Panels. NASA TM-80077, 1979.

Starnes, J.H., Rhodes, M.D. and Williams, J.G. Effect of impact damage and holes on the compressive strength of a graphite/epoxy laminate, Non-destructive evaluation and flaw criticality for composite materials, ASTM STP 696, 1979, pp 145-171.

Sohi, M.M., Hahn, H.T. and Williams, J.G., "The Effect of Resin Toughness and Modulus on Compression Failure Modes of Quasi-isotropic Graphite/Epoxy Laminates," STP 937, American Society for Testing and Materials, Philadelphia, PA, 1987

Hashemi S., Kinloch A.I., Williams J.G., 1987, Interlaminar fracture of composite materials, in: 6th ICCM & 2nd ECCM Conference Proceedings, London, 3: 254-264.

Williams J.G., 2005, NASA research in composite structure damage tolerance and composite applications in the oil industry, in: 46th AIAA Structures, Structural Dynamics & Materials Conference, Austin, Texas.