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Selected Publications of Richard D. Young:

D.M. McGowan, R.D. Young,, G.D. Swancon, and W.A. Waters, 5th NASA/DoD Adv. Compos. Tec. Con., Seattle, Wash., Paper No. A94-33140 (1994).

Young, R. D., Starnes, J. H., Jr. and Hyer, M. W., “Effects of Skewed Stiffeners and Anisotropic Skins on the Response of Compression-Loaded Composite Panels,” Proceedings of the Tenth DoD/NASA/FAA Conference of Fibrous Composites in Structural Design, Hilton Head Island, SC, November 1-4, 1993, Naval Air Warfare Center Report No. NAWACADWAR-94096060, Vol. 1, April 1994, pp. II-109 to II-123.

Young, R. D. and Rankin, C. C., "Modeling and Nonlinear Analyses of a Large-Scale Launch Vehicle Under Combined Thermal and Mechanical Loads," Proceedings of the 37th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, Salt Lake City, Utah, April 15-17, 1996, pp. 2023-2033. AIAA Paper No. 96-1551

Young, R. D., “Prebuckling and Postbuckling Behavior of Stiffened Composite Panels with Axial-shear Stiffness Coupling”, Ph.D. thesis, Department of Engineering Science and Mechanics, Virginia Polytechnic Institute and State University, Blacksburg, VA, 1996.

Young, R. D., Starnes, J. H., Jr., and Hyer, M. W., “Accurate Modeling of the Postbuckling Response of Composite Panels with Skewed Stiffeners,” AIAA Paper No. 97-1306, April 1997.

Seshadri, B. R., Newman, J. C., Jr., Dawicke, D. S., and Young, R. D., "Fracture Analysis of the FAA/NASA Wide Stiffened Panels," Proceedings of the FAA-NASA Symposium on the Continued Airworthiness of Aircraft Structures," DOT/FAA/AR- 92/2, 1997, pp. 513-524

Young, R. D., Rose, C. A., Dávila, C. G., Starnes, J. H., Jr., and Rankin, C. C., “Crack Growth and Residual Strength Characteristics of Selected Flat Stiffened Aluminum Panels,” Proceedings of the First Joint DOD/FAA/NASA Conference on Aging Aircraft, Ogden, UT, July, 1997.

B. R. Seshadri (1), J. C. Newman, Jr. (2), D. S. Dawicke (2) and R. D. Young (2)
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“Fracture Analysis of The FAA/NASA Wide Stiffened Panels”, (no publisher or date given. Perhaps it is an FAA/DOT “AR” report. Most recent reference cited is 1998)
ABSTRACT: This paper presents the fracture analyses conducted on the FAA/NASA stiffened and unstiffened panels using the STAGS (STructural Analysis of General Shells) code with the critical crack-tip-opening angle (CTOA) fracture criterion. The STAGS code with the “plane-strain” core option was used in all analyses. Previous analyses of wide, flat panels have shown that the high-constraint conditions around a crack front, like

plane strain, has to be modeled in order for the critical CTOA fracture criterion to predict wide panel failures from small laboratory tests. In the present study, the critical CTOA value was determined from a wide(unstiffened)panelwithanti-bucklingguides. Theplane-straincoresizewasestimatedfromprevious fracture analyses and was equal to about the sheet thickness. Rivet flexibility and stiffener failure was based on methods and criteria, like that currently used in industry. STAGS and the CTOA criterion were used to predict load-against-crack extension for the wide panels with a single crack and multiple-site damage cracking at many adjacent rivet holes. Analyses were able to predict stable crack growth and residual strength within a few percent (5%) of stiffened panel tests results but over predicted the buckling failure load on an unstiffened panel with a single crack by 10%.

Richard D. Young, Michael P. Nemeth, Timothy J. Collins, and James H. Starnes, Jr. (NASA Langley Research Center Hampton, Virginia 23681-0001), “Nonlinear Analysis of the Space Shuttle Superlightweight LO2 Tank: Part I - Behavior under Booster Ascent Loads”, AIAA 39th Structures, Structural Dynamics and Materials Conference, AIAA-98-1838, 1998
ABSTRACT: Results of linear bifurcation and nonlinear analyses of the Space Shuttle superlightweight (SLWT) external liquid-oxygen (LO2) tank for an important early booster ascent loading condition are presented. These results for thin-walled linear elastic shells that are subjected to combined mechanical and thermal loads illustrate an important type of response mode that may be encountered in the design of other liquid-fuel launch vehicles. Linear bifurcation analyses are presented that predict several nearly equal eigenvalues that correspond to local buckling modes in the forward ogive section of the LO2 tank. In contrast, the nonlinear response phenomenon is shown to consist of short-wavelength bending deformations in the forward ogive and barrel sections of the LO2 tank that grow in amplitude in a stable manner with increasing load. Imperfection sensitivity analyses are presented that show that the presence of several nearly equal eigenvalues does not lead to a premature general instability mode for the forward ogive section. For the linear bifurcation and nonlinear analyses, the results show that accurate predictions of the response of the shell generally require a large-scale, high-fidelity finite-element model. Results are also presented that show that the SLWT LO2 tank can support loads in excess of approximately 2.6 times the values of the operational loads considered.

Young, R. D., Rouse, M., Ambur, D. R., and Starnes, J. H., Jr., "Residual Strength Pressure Tests and Nonlinear Analyses of Stringer- and Frame-Stiffened Aluminum Fuselage Panels with Longitudinal Cracks," Proceedings of the Second Joint NASA/FAA/DOD Conference on Aging Aircraft, Williamsburg, VA, August 31-September 3, 1998. NASA/CP-1999-208982/Part 1, January 1999, pp. 408-426.

Young, R. D., Rose, C. A., and Starnes, J. H., Jr., “Nonlinear Local Bending Response and Bulging Factors for Longitudinal and Circumferential Cracks in Pressurized Shells,” Proceedings of the 3rd Joint FAA/ DoD/NASA Conference on Aging Aircraft, Albuquerque, NM, September 20-23, 1999.

Dawicke, D. S., Newman, J. C., Jr., Starnes, J. H., Jr., Rose, C. A.; Young, R. D., and Seshadri, B. R., "Residual Strength Analysis Methodology: Laboratory Coupons to Structural Components," Proceedings of the Third Joint FAA/DOD/NASA Conference on Aging Aircraft, Albuquerque, NM, September 20-23, 1999.

Ambur, D. R., Rouse, M., Young, R. D., and Perez-Ramos, C., "Evaluation of an Aluminum Panel with Discrete-Source Damage and Subjected to Combined Loading Conditions," Proceedings or the 40th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, St. Louis, MO, April 12-15, 1999. AIAA Paper AIAA-99-1439, 1999.

James H. Starnes, Jr., Damodar R. Ambur, Richard D. Young, and Charles E. Harris (NASA Langley Research Center, Hampton, VA 23681-2199, USA), “Experimental verification of the analytical methodology to predict the residual strength of metallic shell structure”, Society for Experimental….(1999 –cs.odu.edu)
ABSTRACT: Experimental and analysis results for a curved, stiffened aluminum fuselage panel tested in a combined loads test machine with combined internal pressure, axial compression, and torsonal shear loads are described. The experimental and analytical strain results for the panel with and without discrete source damage are presented. The effect of notch tip geometry on crack growth predictions is addressed. The crack growth trajectory predictions for the panel are presented for the applied loading conditions at failure. (Unfortunately, the pdf file does not permit cutting and pasting the 10 references listed at the end of the 4-page file.)

Young, Richard D. (1) and Rankin, Charles C. (2)
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(2) Lockheed Martin Missiles and Space Company, Palo Alto, California
“Modeling and nonlinear structural analysis of a large-scale launch vehicle”, AIAA Journal of Spacecraft and Rockets, Vol. 36, No. 6, pp. 804-811, 1999
ABSTRACT: Advanced modeling and analysis capabilities of a state-of-the-art general purpose finite element code, developed for nonlinear structural analysis of launch vehicles, are described. In particular, the application of these capabilities to nonlinear analyses of the new Space Shuttle superlightweight external liquid-oxygen tank are presented that can be used as a guide for conducting similar analyses on future launch vehicles. A typical prelaunch loading condition with combined thermal and mechanical loads is considered, and applications of the advanced modeling and analysis capabilities to linear bifurcation buckling and nonlinear static analyses are presented. The results for this problem illustrate a localized short-wavelength bending response, and show that a high-fidelity model is required to represent the behavior accurately. A mesh refinement strategy is presented that is based on the linear bifurcation buckling analyses and does not require respecification of the shell wall properties and load. Specifically, mesh refinement is simplified by using user-written subroutines to describe the spatial distribution of complex shell wall properties and loading conditions.

Nemeth, M. P., Britt, V. O., Young, R. D., Collins, T. J., and Starnes, J. H., Jr., "Nonlinear Behavior of Space Shuttle Superlightweight Liquid-Oxygen Tank Under Prelaunch Loads," Journal of Spacecraft and Rockets, Vol. 36, No.6, November-December, 1999, pp. 788-803.

Nemeth, M. P., Young, R. D., Collins, T. J., and Starnes, J. H., Jr., "Nonlinear Behavior of Space Shuttle Super-lightweight Liquid-Oxygen Tank Under End-of-Flight Loads," Journal of Spacecraft and Rockets, Vol. 36, No.6, November-December, 1999, pp. 828-835.

Young, R. D., Nemeth, M. P., Collins, T. J., and Starnes, J. H., Jr.,"Nonlinear Behavior of Space Shuttle Super-lightweight Liquid-Oxygen Tank Under Booster Ascent Loads," Journal of Spacecraft and Rockets, Vol. 36, No.6, November-December, 1999, pp. 820-827.

Nemeth, M. P., Young, R. D., Collins, T. J., and Starnes, J. H., Jr., "Effects of Welding-Induced Imperfections on Behavior of Space Shuttle Superlightweight Liquid-Oxygen Tank," Journal of Spacecraft and Rockets, Vol. 36, No.6, November-December, 1999, pp. 812-819.

Young, R. D., Rose, C. A., and Starnes, J. H., Jr., “Nonlinear Bulging Factors for Longitudinal and Cicumferential Cracks in Cylindrical Shells Subjected to Combined Loads,” AIAA Paper No. 2000-1514, April

2000.

Richard D. Young (1), Michael W. Hyer (2) and James H. Starnes, Jr. (1)
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“Prebuckling and Postbuckling Response of Tailored Composite Stiffened Panels with Axial-Shear Coupling”, AIAA Paper 2000-1459, 41st AIAA Structures, Structural Dynamics and Materials Conference, 2000
ABSTRACT: Results of a numerical parametric study of the prebuckling and postbuckling response of tailored composite stiffened panels with axial-shear coupling are presented. In the stiffened panels, axial-shear stiffness coupling is created by rotating the stiffener orientation and tailoring the skin laminate anisotropy. The panels are loaded in axial compression and the effects of stiffener orientation and skin anisotropy on the panel stiffness, buckling parameters, and axial-shear coupling response are described. Results are obtained from a nonlinear general shell finite element analysis computer code. The prebuckling and postbuckling responses can be affected by both the stiffener orientation and skin laminate anisotropy, and the effects are different and load dependent. The results help identify different mechanisms for axial-shear coupling, and show that a load-dependent structural response can be controlled by selecting appropriate stiffener and skin parameters.

Richard D. Young, Cheryl A. Rose, and James H. Starnes, Jr. (NASA Langley Research Center Hampton,Virginia 23681-2199), “Skin, Stringer, and Fastener Loads in Buckled Fuselage Panels”, AIAA 42nd Structures, Structural Dynamics and Materials Conference, AIAA-2001-1326, 2001
ABSTRACT: The results of a numerical study to assess the effect of skin buckling on the internal load distribution in a stiffened fuselage panel, with and without longitudinal cracks, are presented. In addition, the impact of changes in the internal loads on the fatigue life and residual strength of a fuselage panel is assessed. A generic narrow-body fuselage panel is considered. The entire panel is modeled using shell elements and considerable detail is included to represent the geometric-nonlinear response of the buckled skin, cross section deformation of the stiffening components, and details of the skin-stringer attachment with discrete fasteners. Results are presented for a fixed internal pressure and various combinations of axial tension or compression loads. Results illustrating the effect of skin buckling on the stress distribution in the skin and stringer, and fastener loads are presented. Results are presented for the pristine structure, and for cases where damage is introduced in the form of a longitudinal crack adjacent to the stringer, or failed fastener elements. The results indicate that axial compression loads and skin buckling can have a significant effect on the circumferential stress in the skin, and fastener loads, which will influence damage initiation, and a comparable effect on stress intensity factors for cases with cracks. The effects on stress intensity factors will influence damage propagation rates and the residual strength of the panel.

James H. Starnes, Jr., James C. Newman, Jr., Charles E. Harris, Robert S. Piascik, Richard D. Young and Cheryl A. Rose (NASA Langley Research Center Mail Stop 190 Hampton, VA 23681-2199, USA), “Advances in Structural Integrity Analysis Methods for Aging Metallic Airframe Structures with Local Damage”, RTO AVT Specialists’ Meeting on “Life Management Techniques for Ageing Air Vehicles”, held in Manchester, United Kingdom, 8-11 October 2001, published in RTO-MP-079(II).
ABSTRACT: Analysis methodologies for predicting fatigue-crack growth from rivet holes in panels subjected to cyclic loads and for predicting the residual strength of aluminum fuselage structures with cracks and subjected to combined internal pressure and mechanical loads are described. The fatigue-crack growth analysis methodology is based on small-crack theory and a plasticity induced crack-closure model, and the effect of a corrosive environment on crack-growth rate is included. The residual strength analysis methodology is based on the critical crack-tip-opening-angle fracture criterion that characterizes the fracture behavior of a material of

interest, and a geometric and material nonlinear finite element shell analysis code that performs the structural analysis of the fuselage structure of interest. The methodologies have been verified experimentally for structures ranging from laboratory coupons to full-scale structural components. Analytical and experimental results based on these methodologies are described and compared for laboratory coupons and flat panels, small-scale pressurized shells, and full-scale curved stiffened panels. The residual strength analysis methodology is sufficiently general to include the effects of multiple-site damage on structural behavior.

Cheryl A. Rose, Richard D. Young, and James H. Starnes, Jr. (NASA Langley Research Center Hampton, Virginia 23681-2199), “The Nonlinear Response of Cracked Aluminum Shells Subjected to Combined Loads”, AIAA 42nd Structures, Structural Dynamics and Materials Conference, AIAA-2001-1395, 2001
ABSTRACT: The results of a numerical study of the nonlinear response of thin unstiffened aluminum cylindrical shells with a longitudinal crack are presented. The shells are analyzed with a nonlinear shell analysis code that accurately accounts for global and structural response phenomena. The effects of initial crack length on the prebuckling, buckling and postbuckling responses of a typical shell subjected to axial compression loads, and subjected to combined internal pressure and axial compression loads are described. Both elastic and elastic-plastic analyses are conducted. Numerical results for a fixed initial crack length indicate that the buckling load decreases as the crack length increases for a given pressure load, and that the buckling load increases as the internal pressure load increases for a given crack length. Furthermore, results indicate that predictions from an elastic analysis for the initial buckling load of a cracked shell subjected to combined axial compression and internal pressure loads can be unconservative. In addition, the effect of crack extension on the initial buckling load is presented.

Nemeth, M. P., Young, R. D., Collins, T. J., and Starnes, J. H., Jr. (NASA Langley Research Center, Hampton, VA 23681-2199, USA), "Effects of Initial Geometric Imperfections on the Nonlinear Response of the Space Shuttle Superlightweight Liquid-Oxygen Tank," International Journal of Non-Linear Mechanics, Vol. 37, No.4-5, June, 2002, pp. 723-744, Special Issue: Stability and Vibration in Thin-Walled Structures, doi:10.1016/S0020-7462(01)00095-6
ABSTRACT: The results of an analytical study of the elastic buckling and non-linear behavior of the liquid-oxygen tank for the new Space Shuttle superlightweight external fuel tank are presented. Selected results that illustrate three distinctly different types of non-linear response phenomena for thin-walled shells which are subjected to combined mechanical and thermal loads are presented. These response phenomena consist of a bifurcation-type buckling response, a short-wavelength non-linear bending response, and a non-linear collapse or “snap-through” response associated with a limit point. The effects of initial geometric imperfections on the response characteristics are emphasized. The results illustrate that the buckling and non-linear response of a geometrically imperfect shell structure subjected to complex loading conditions may not be adequately characterized by an elastic linear bifurcation buckling analysis, and that the traditional industry practice of applying a buckling-load knock-down factor can result in an ultra-conservative design. Results are also presented that show that a fluid-filled shell can be highly sensitive to initial geometric imperfections, and that the use a buckling-load knock-down factor is needed for this case.

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“Structural Stability of a Stiffened Aluminum Fuselage Panel Subjected to Combined Mechanical And Internal Pressure Loads”, AIAA 44th Structures, Structural Dynamics and Materials Conference, AIAA-2003-1423, 2003

ABSTRACT: Results from an experimental and analytical study of a curved stiffened aluminum panel subjected to combined mechanical and internal pressure loads are presented. The panel loading conditions were simulated using a D-box test fixture. Analytical buckling load results calculated from a finite element analysis are presented and compared to experimental results. Buckling results presented indicate that the buckling load of the fuselage panel is significantly influenced by internal pressure loading. The experimental results suggest that the stress distribution is uniform in the panel prior to buckling. Nonlinear finite element analysis results correlates well with experimental results up to buckling.

Richard D. Young; Cheryl Rose, “STAGS Developments for Residual Strength Analysis Methods for Metallic Fuselage Structures”, AIAA Paper AIAA 2014-0848, 55th AIAA Structures Conference, January 13-17, 2014