Professor Victor I. Weingarten

Founded Structural Research & Analysis Corp (SRAC)
Developed the COSMIC software for structural analysis
Developed the design criteria for buckling of shells with P. Seide and J.P. Peterson (NASA SP8007, 1968)

Selected Publications:

Seide, P.; Weingarten, V. I.; and Morgan, E. J.: The Development of Design Criteria for Elastic Stability of Thin Shell Structures. STL/TR-60-0000-19425, U.S. Air Force, Dec. 1960.
ABSTRACT: The results of an extensive experimental program on the stability of cylindrical and conical shells under various loading conditions are presented and discussed. Loading conditions for both cylinders and cones include axial compression, axial compression with internal or external pressure, bending with and without internal pressure, axial compression combined with both bending and internal pressure, and a limited amount of data on torsion of conical shells. Where feasible, values suitable for design are recommended and areas needing additional theoretical and experimental study are indicated.

Seide, P. and Weingarten, V.I., “On the buckling of circular cylindrical shells and other thin sections”, J. Appl. Mech., Vol. 28, No. 1, 1961

Seide, P. and Weingarten, V. I., “On the Buckling of Cylindrical Shells under Pure Bending," Journal of Applied Mechanics, Vol. 28, 1961, pp. 112-116.

Paul Seide and Victor I. Weingarten, “On the stability of internally pressurized conical shells under compression”, 1961
ABSTRACT: The results of an investigation to determine the influence of small deflections on the stability of internally pressurized conical shells under axial compression is presented. The critical axial load is found to depend on a geometry parameter for the small end of the cone, the internal pressure, and, unlike results for cylindrical shells, the end fixity of the shell. Experimentally obtained data are in qualitative agreement with theory but differ quantitatively, probably because of yielding of the low melting temperature alloy used to clamp the ends of the shells and yielding of the shell material.

Weingarten, V.I., “Stability under Torsion of Circular Cylindrical Shells with an Elastic Core”, ARS Journal, 32, 637-639, 1962.

V. V. Bolotin, "The Dynamic Stability of Elastic Systems, " translated by V. I. Weingarten, L. B. Greszczuk, K. N. Trirogoff,and K. D. Gallegos, Hoden-Day, San Francisco (1964)

“Buckling of thin-walled circular cylinders”, NASA Space Vehicle Design Criteria (Structures), NASA Technical Report SP-8007, 1968, also: NASA/SP-8007, Seide, P. Weingarten, V. I. and Peterson, J.P., Buckling of thin-walled circular cylinders, NASA SPACE VEHICLE DESIGN CRITERIA (Structures), NASA (Washington, DC, United States), September,1965

Weingarten, V.I., Morgan, E.J. and Seide, P., "Elastic stability of thin-walled cylindrical and conical shells under axial compression, AIAA J., Vol. 3, No. 3, March 1965

V.I. Weingarten, E.J. Morgan and P. Seide, Elastic stability of thin-walled cylindrical and conical shells under combined internal pressure and axial compression, AIAA J. 3 (1965) 1118-1125.

Weingarten, V.I., "Free vibration of ring-stiffened conical shells", AIAA Journal, Vol. 3, No, 8, 1965, pp. 1475-1481

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"Vibrations of Pressure Loaded Hyperboloidal Shells", ASCE Journal of the Engineering Mechanics Division, Vol. 98, No. 5, September/October 1972, pp. 1017-1030
ABSTRACT: This paper investigates the effect of external lateral pressure on the free vibrations of hyperboloidal shells of revolution. A finite element computer program was developed based on Sander's linear shell theory. This analysis was in good agreement with available experimental results and can be used in the future cooling tower structures. The most interesting result obtained from the investigation was the discovery that for certain hyperboloidal shell geometrics, the lowest frequency mode shapes contain more than one meridional half wave. This result was verified experimentally in the reference.

Daniel R. Veronda (1) and Victor I. Weingarten (2)
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"Stability of Pressurized Hyperboloidal Shells", ASCE Journal of the Engineering Mechanics Division, Vol. 101, No. 5, September/October 1975, pp. 663-678
ABSTRACT: The data obtained are compared with predicted results using a linear finite element stability analysis and a corresponding nonlinear analysis wherein the effects of geometric nonlinearities are included. Experimental buckling loads were in good agreement with linear theory predictions, and the geometric nonlinearities were found to have little effect on the calculated critical loads of the hyperboloids tested. The experimental results were also compared to analytical data for cylindrical shells. The ratio of experimental results to analytical predictions were far lower for cylindrical shells than hyperboloidal shells. These results indicate that hyperboloidal shells have a lower sensitivity to geometric imperfections than cylindrical shells. The experimental data for internally pressurized hyperboloidal shells under axial load indicate that the axial buckling value asymptoptotically approaches a constant value when the additional load carried by the internal pressure is subtracted. Sanders thin shell (strain-displacement) equations were used to develop finite element models for both the linear and nonlinear analyses.

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"Stability of Hyperboloidal Shells", ASCE Journal of the Structural Division, Vol. 101, No. 7, July 1975, pp. 1585-1602
ABSTRACT: An analytical and experimental investigation was carried out to determine the buckling loads of hyperboloidal shells with different geometries subjected to the axisymmetric loadings of external pressure and axial compression. Sander's thin shell equations were used in conjunction with the finite element method to

determine the bifurcation buckling load of the shell. The experimental program yielded data on the instability behavior of hyperboloidal shells subjected to combined loadings. Molded PVC specimens were used in the experiments. Shell specimens were: (1) Clamped on both ends; and (20 clamped on one end and free on the other end. The experimental data were found to be in good agreement with the analysis for all types of loading conditions.

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"Stability of Shells Attached to An Elastic Core", ASCE Journal of the Engineering Mechanics Division, Vol. 102, No. 5, September/October 1976, pp. 839-849
ABSTRACT: The effect upon the buckling strength of a soft elastic core attached to a shell of revolution subjected to axisymmetric loads is investigated. The axisymmetric stress problem is solved by using the finite element method to solve the body of revolution problem with an axis of material symmetry subjected to Fourier expandable thermal, body force, and surface traction loading. The governing equations are derived for a triangular toroidal continuum element attached to shell elements. The elastic core influence coefficient matrix of the core is derived by applying the unit line load at the interface nodal point of the core. The inversion of the influence coefficient matrix yields an equivalent stiffness matrix of the core which is then combined with the shell stiffness matrix. Results from this investigation are in good agreement with available analytical and experimental results for cylindrical shells. New results are obtained for conical and spherical shells.

Seide, P,. Weingarten, V. I., and Masri, S. F. "Buckling Criteria and Application of Criteria to Design of Steel Containment Shell," NUREG-CR0793, March 1979.