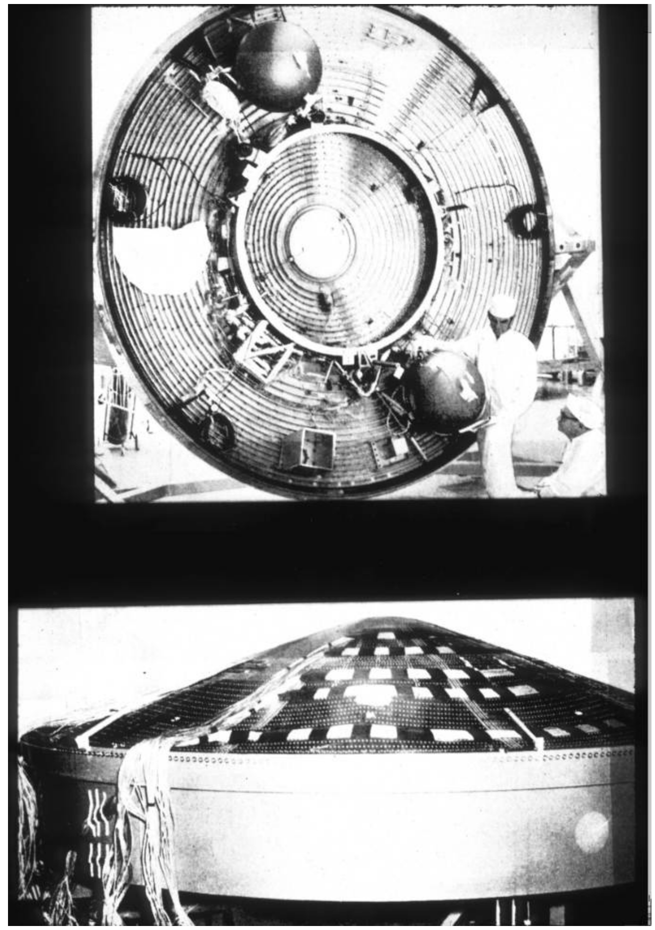
Dr Gerald Allen Cohen (1931- 2014)



Ring-stiffened shallow conical shell designed with the use of FASOR for NASA's Viking project in the 1970s. (from NASA TN D-7853, 1975, by Walter L. Heard, Jr., Melvin S. Anderson & Wendell B. Stephens)

Obituary:

Gerald Allen Cohen, 83, passed away Oct. 1, 2014, at his home in Laguna Beach.

Cohen was born March 5, 1931, in St. Louis, Mo., to Benjamin and Leah Cohen.

He was a remarkable mathematician and a very talented engineer who contributed greatly to the U.S. space program and several other engineering projects.

His academic pursuits began in 1948 at Purdue University. A full scholarship brought him to the California Institute of Technology for post-graduate work and he returned to Purdue to receive his Ph.D in mechanical engineering by the age of 25. Interest in post-Ph.D math studies brought him to Brown University and later he was a professor of mathematics at Virginia Tech University.

After working for Ford Aeronutronics, Cohen started his own company, Structures Research Associates. **There he developed the software program FASOR (Field Analysis of Shells of Revolution)** which he contracted to NASA, Ball Corporation, and others. He was known by his colleagues as the best in his field and by his sons and their peers as a math and physics homework tutor.

Athletic and competitive, Cohen was an avid baseball fan, partial to the St. Louis Cardinals, as he made it past the team's first cuts in his youth when the Cardinals were then known as the St. Louis Browns. The highlight of his every year was his Alaskan/Canadian fishing trip with his son, Gerald.

Cohen is survived by his wife, Eivor; four sons, Ben, Ron, Gerald and Steve; grandson, Jaden; brothers Ray and Stan; and many friends.

A private memorial service at sea was held Oct. 11, 2014, off the coast of San Pedro, Calif.

Selected Publications:

Cohen, G. A., "Computer Analysis of Asymmetric Free Vibrations of Ring Stiffened Orthotropic Shells of Revolution," AIAA Journal, Vol. 3, No. 12, 1965, pp. 2305-2312.

G. A. Cohen, "Conservativeness of a normal pressure field acting on a shell", AIAA J. Vol. 4, 1966, pp. 1886-1887

Cohen, G. A., "Buckling of Axially Compressed Cylindrical Shells with Ring-Stiffened Edges," AIAA Journal, Vol. 4, Oct. 1966, pp. 1859-1862.

Cohen, G. A., "User Document for Computer Programs for Ring-Stiffened Shells of Revolution," NASA CR-2086, 1973; "Computer Analysis of Ring-Stiffened Shells of Revolution," NASA CR-2085, 1973; "Computer Program for Analysis of Imperfection Sensitivity of Ring-Stiffened Shells of Revolution," NASA CR-1801, 1971.

G.A. Cohen, "Feasibility study of shell buckling analysis using the modified structure method", 1972, NASA (no other details nor abstract is given).

Gerald A. Cohen (Structures Research Associates, Laguna Beach, Calif., U.S.A.), "Analysis of multicircuit shells of revolution by the field method", Computer Methods in Applied Mechanics and Engineering, Vol. 8, No. 3, July-August 1976, pp. 301-318, doi:10.1016/0045-7825(76)90020-7
ABSTRACT: The field method, presented previously for the solution of linear boundary-value problems defined on one-dimensional open branch domains, is extended to one-dimensional domains which contain circuits. This method converts the boundary-value problem into two successive numerically stable initial-value problems, which may be solved by standard forward integration techniques. Also presented is a new treatment of singular boundary conditions (kinematic constraints) — this is problem independent with respect to both

accuracy and efficiency. The method has been implemented in a computer program which calculates the asymmetric response of ring-stiffened orthotropic multicircuit shells of revolution.

Gerald A. Cohen (Structures Research Associates, Laguna Beach, California, USA), “Transverse shear stiffness of laminated anisotropic shells”, Computer Methods in Applied Mechanics and Engineering, Vol. 13, No. 2, February 1978, pp. 205-220, doi:10.1016/0045-7825(78)90058-0
ABSTRACT: The additional constitutive equations required by transverse shear deformation theory of anisotropic heterogeneous shells are derived without the usual assumption of thickness distribution for either transverse shear stresses or strains. The derivation is based on Taylor series expansions about a generic point for stress resultants and couples which identically satisfy plate equilibrium equations. These equations give the in-surface stress resultants and couples in terms of the transverse shear stress resultants at the point and arbitrary constants, which may be interpreted as redundant “forces”. Starting from these expressions, we derive statically correct expressions (in terms of the transverse shear stress resultants and redundants) of the following variables: (1) in-surface stresses, using the stretching-bending constitutive equations and the Kirchhoff distributions of in-surface strains, (2) transverse shear stresses, by integration in the normal direction of the three-dimensional equilibrium equations, and (3) the area density of transverse shear strain energy, by integration in the normal direction of the corresponding volumetric density. Finally, by applying Castigliano's theorem of least work, the shear strain energy is minimized with respect to the redundants, thereby leading to the desired constitutive equations. Corresponding transverse shear stiffnesses are presented for several laminated walls, and reasonable agreement is obtained between transverse shear deformation plate theory using these stiffnesses and exact three-dimensional elasticity solutions for the problem of cylindrical bending of a plate.

Gerald A. Cohen (Structures Research Associates, Laguna Beach, California, USA), “FASOR — a program for stress, buckling and vibration of shells of revolution”, Advances in Engineering Software (1978), Vol. 3, No. 4, October 1981, pp.155-162, doi:10.1016/0141-1195(81)90013-9
ABSTRACT: FASOR (Field Analysis of Shells of Revolution) is a user-oriented code for the analysis of stiffened, laminated axisymmetric shells. Very general shell geometries are allowed in that the reference surface meridian may form a branched, multi-circuit figure. Modes of response treated are linear asymmetric and geometrically nonlinear axisymmetric prebuckling, and asymmetric buckling and vibration under static axisymmetric loads. Bifurcation buckling under asymmetric loads is also treated by using a symmetrized prebuckling state based on the linear response of a user-specified meridian. For each mode of response, the user may specify any combination of orthotropic or anisotropic material properties with classical or transverse shear deformation shell theories. FASOR employs a numerical integration method (called the field method) whereby a numerically unstable linear boundary-value problem (all modes of response reduce to a sequence of such problems) is converted into two successive numerically stable initial-value problems. In this context, numerical stability means that round-off errors introduced at each step of the integration process tend to decay out. As a consequence, solution accuracy is controlled essentially by a single number, the truncation error tolerance, which is satisfied by automatically adjusting the size of each integration step. The field method thus eliminates the need for mesh generation required by finite element and finite difference methods, and the associated problem of numerical convergence. It also provides for automatic determination of response storage points so as to obtain a uniformly valid discrete approximation of the continuous response. In this paper the field method is briefly described, basic aspects of the mathematical model are discussed, the organization of input data is presented, and input and plot output are given for specific examples.

Gerald A. Cohen (Structures Research Associates, Laguna Beach, California, U.S.A.), “FASOR—A second generation shell of revolution code”, Computers & Structures, Vol. 10, Nos. 1-2, April 1979, pp. 301-309,

doi:10.1016/0045-7949(79)90099-3
ABSTRACT: An integrated computer program entitled Field Analysis of Shells of Revolution (FASOR) currently under development for NASA is described. When completed, this code will treat prebuckling, buckling, initial postbuckling and vibrations under axisymmetric static loads as well as linear response and bifurcation under asymmetric static loads. Although these modes of response are treated by existing programs, FASOR extends the class of problems treated to include general anisotropy and transverse shear deformations of stiffened laminated shells. At the same time, a primary goal is to develop a program which is free of the usual problems of modeling, numerical convergence and ill-conditioning, laborious problem setup, limitations on problem size and interpretation of output. The field method is briefly described, the shell differential equations are cast in a suitable form for solution by this method and essential aspects of the input format are presented. Numerical results are given for both unstiffened and stiffened anisotropic cylindrical shells and compared with previously published analytical solutions.

Gerald A. Cohen (Structures Research Associates Laguna Beach, California, U.S.A.), “Comment on: Note on the effect of transverse shear deformation in laminated anisotropic plates : (by E. Reissner and published in this journal, vol. 20 (1979) 203–209)”, Computer Methods in Applied Mechanics and Engineering, Vol. 20, No. 2, November 1979, p. 211, doi:10.1016/0045-7825(79)90019-7

Gerald A. Cohen (Structures Research Associates, Laguna Beach, Calif, U.S.A.), “Buckling of laminated anisotropic shells including transverse shear deformation”, Computer Methods in Applied Mechanics and Engineering, Vol. 26, No. 2, May 1981, pp.197-204, doi:10.1016/0045-7825(81)90094-3
ABSTRACT: The subspace iteration method used in the buckling options of the shell code FASOR is discussed. Buckling modes of a laminated anisotropic cylindrical shell and a sandwich spherical cap are presented and compared with previously published results.

Gerald A. Cohen (Structures Research Associates Laguna Beach, California), “Effect of Transverse Shear Deformation on Anisotropic Plate Buckling”, Journal of Composite Materials, 1982 , vol. 16, no. 4, pp. 301-312, doi: 10.1177/002199838201600404
ABSTRACT: Critical in-plane normal and shear loads of rectangular anisotropic laminated plates are presented. These were calculated using the shell code FASOR, which includes the effect of transverse shear deformation. For simply-supported orthotropic laminates with midplane symmetry normal buckling loads are verified by a closed-form solution derived from transverse shear deformation plate theory. Results are compared to previously pub lished solutions from three-dimensional elasticity theory and classical plate theory.

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“Sensitivity of buckling loads of anisotropic shells of revolution to geometric imperfections and design changes”, Computers & Structures, Vol. 31, No. 6, 1989, pp. 985-995, doi:10.1016/0045-7949(89)90283-6
ABSTRACT: Buckling load sensitivity calculations in the shell-of-revolution program FASOR are discussed. This development is based on Koiter's initial postbuckling theory, which has been generalized to include the effect of stiffness changes, as well as geometric imperfections. The implementation in FASOR is valid for anisotropic, as well as orthotropic, shells. Examples are presented for cylindrical panels under axial compression, complete cylindrical shells in torsion, and antisymmetric angle-ply cylindrical panels under edge shear.