Dr. E. L. Axelrad

Selected Publications:

E.L. Aksel'rad (Axelrad), Flexure and instability of thin-walled pressurized tubes, Izvestiya Akademii Nauk SSSR, Otdelenie Tekhnicheskikh Nauk, Mekhanika i Mashinostroenie 1 (1962) 98–114 (in Russian).

E.L. Axelrad, Refinement of buckling-load analysis for tube flexure by way of considering precritical deformation, Izvestiya Akademii Nauk SSSR, Otdelenie Tekhnicheskikh Nauk, Mekhanika i Mashinostroenie 4 (1965) 133–139 (in Russian).

E. Axelrad, "Flexible shell-theory and buckling of toroidal shells and tubes", Archive of Applied Mechanics, Vol. 47, No. 2, 1978, pp. 95-104, doi: 10.1007/BF00536446
ABSTRACT: Flexible shells, designed to sustain elastic displacements, have a "semimembrane" type of deformation, described by simplified equations. In what follows, flexible shell equations are derived and used to analyse bending of curved tubes and buckling of tubes and toroidal shells under external pressure, as interdependent problems. Design formulas and curves are presented.

Axelrad, E. L.: Schalentheorie [Shell Theory], B. G. Teubner, Stuttgart 1983

E. L. Axelrad and F. A. Emmerling (Institut für Mechanik, HSBw (DFG), München, West Germany), "Große Verformungen und Traglasten elastischer Rohre unter Biegung und Außendruck", Archive of Applied Mechanics, Vol. 53, No. 1, 1983, pp. 41-52, doi: 10.1007/BF01352170
ABSTRACT: Flexure of cylinders and slightly curved pressurized tubes is investigated for given conditions on the edges, in particular for end flanges. The large precritical deformation is determined with the help of the Flexible-Shell-Theory. The stability analysis of the deformed shell is carried out with the aid of the hypothesis of local buckling. The critical bending moments which determine the collapse load are presented for various tube lengths, initial curvatures and external-pressure values by graphs.

E. L. Axelrad (Universität der BW, München, Institut fuer Mechanik, Werner Heisenberg Weg 39, 8014, Neubiberg, West Germany), "On local buckling of thin shells", International Journal of Non-Linear Mechanics, Vol. 20, No. 4, 1985, pp. 249-259, doi:10.1016/0020-7462(85)90033-2
ABSTRACT: A class of problems is considered where the buckling initially starts only in a part of the shell—locally. The stability analysis is focused on the zone of initial buckling. This leads to radical simplification. First the basic hypothesis and stability equations are formulated. Closed-form stability criteria asymptotically exact for very thin shells are discussed. This gives sufficient conditions for the local character of buckling and for the adequacy of the asymptotic approximation. The analysis taking into account the variation of stresses and shape inside the buckling zone results in a check of stability by hand calculations or by simple coding of a desk-top computer. The adequacy of the simplest representation of the stress and strain variation in the buckling zone is tested.

E. L. Axelrad (Institut für Mechanik, HSBw (DFG), München, West Germany), "Elastic tubes—Assumptions, equations, edge conditions", Thin-Walled Structures, Vol. 3, No. 3, 1985, pp. 193-215, doi:10.1016/0263-8231(85)90003-5

ABSTRACT: This paper is concerned with further development of tube-analysis methods which are as simple as necessary for design and as accurate as possible in the shell theory. The basic assumptions are stated in Section 2. For ‘long’ tubes their accuracy is estimated in the course of derivation and simplification of nonlinear equations of axisymmetric flexure (Section 3). These equations and the estimates of the assumptions are extended to two-dimensional problems in Section 4. Equations of the semi-momentless theory encompassing shear deformation and appropriate edge conditions are discussed in Sections 5 and 6. Their solution, including a simple approximation, is in Sections 7–9 preceded by known calculations and experiment.

E. L. Axelrad, **Theory of Flexible Shells**, vol. 28 of North-Holland Series in Applied Mathematics and Mechanics, North-Holland, Amsterdam, The Netherlands, 1987.

E. L. Axelrad and F. A. Emmerling (Institut für Mechanik, Universität der Bundeswehr. D-8014, Neubiberg, F. R., Germany), “Intrinsic shell theory relevant for realizable large displacements”, International Journal of Non-Linear Mechanics, Vol. 22, No. 2, 1987, pp. 139-150, doi:10.1016/0020-7462(87)90016-3
ABSTRACT: The thin-shell theory is specialized for those large deformations realizable by small strain. This provides three different ways leading from the general theory to the intrinsic non-linear theory of flexible shells. The theory is applied to large elastic displacements of finite-length tubes. Their collapse is described as starting by local instability.

Axelrad, E. L. and F. A. Emmerling. "Vector and Tensor Form of Intrinsic Shell-Theory Relations," International Journal of Non-Linear Mechanics, 23: No. 1, 9-23, (1988).

E.L. Axelrad (Auf der Trat 3, 82393 Iffeldorf, Germany), “Shell theory and its specialized branches”, International Journal of Solids and Structures, Vol. 37, No. 10, March 2000, pp. 1425-1451, doi:10.1016/S0020-7683(98)00328-X
ABSTRACT: For small-strain unrestricted deformation of thin elastic shells the field equations and variational principles are rederived in terms of variables immediately representing physical quantities. The relevant strain and stress tensors turn out to be identical to those commonly known as the ‘modified’ and the ‘best’. The nonlinear theory exhibits a static-geometric duality. For orthogonal coordinates the tensor-form theory leads to a modification of the Luré–Novozhilov formulation. The general theory is specialized to that of ‘quasi-shallow shells’, to the membrane theory and to flexible-shell theory, which are explored with respect to basic hypotheses and accuracy.

E.L. Axelrad (137 Chapman Rd., Woodside, California 94062, USA), “On the theory of quasi-shallow shells”, Advances in the Mechanics of Plates and Shells, Solid Mechanics and Its Applications, edited by D. Durban et al, 2002, Vol. 88, pp. 33-48, doi: 10.1007/0-306-46954-5_3
ABSTRACT: The theory of small-strain unrestricted deformation of thin elastic shells is specialized to the ‘Donnell-type’ theory of quasi-shallow shells, which owes its consequent - intrinsic and dual - formulation to the idea first enunciated by Avinoam Libai. This theory is explored with respect to the accuracy, adequacy range and the physical meaning of its basic hypotheses.