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Selected Publications:

D.J. Dawe, “Finite deflection analysis of arches”, Int. J. for Numerical Methods in Engineering, Vol. 3, 1971, pp. 529-552

D.J. Dawe (Department of Civil Engineering, University of Birmingham, Birmingham, England), “Finite strip buckling analysis of curved plate assemblies under biaxial loading”, International Journal of Solids and Structures, Vol. 13, No. 11, 1977, pp. 1141-1155, doi:10.1016/0020-7683(77)90083-X
ABSTRACT: A finite strip method is presented for calculating the linear buckling stresses of structural assemblies of long, thin plate components which, in general, are curved and which are rigidly joined together at their longitudinal edges. It is assumed that on buckling under the action of a biaxial direct stress field the perturbation forces and displacements all vary sinusoidally in the longitudinal direction. A stiffness matrix relating the amplitudes of the perturbation forces and displacements is developed for the curved strip on the further assumption of relatively high-order polynomial variations of the displacement components around the plate width. Numerical results are presented of the application of the curved strip in calculating the buckling stresses of plates, cylinders, panels and formed sections.

D.J. Dawe (Department of Civil Engineering, The University of Birmingham, Birmingham B15 2TT, England), “Finite strip models for vibration of mindlin plates”, Journal of Sound and Vibration, Vol. 59, No. 3, August 1978, pp. 441-452, doi:10.1016/S0022-460X(78)80009-1
ABSTRACT: Four finite strip models are developed for the flexural vibration analysis of rectangular plates based on Mindlin theory which takes account of transverse shear deformation and of rotary inertia. The strips are simply supported at their ends and differ one from another in the order of interpolation employed to represent the variation of each of the plate deflection and the two rotations across the strip. The four models are based in turn on quadratic, cubic, quartic and quintic interpolation. Numerical results are presented of applications of the strip models to the calculation of the natural frequencies of both thin and moderately thick plates. The influence that the assumed value of the shear coefficient has on natural frequencies is considered for two particular moderately thick plates.

D.J. Dawe and O.L. Roufaeil (Department of Civil Engineering, The University of Birmingham, Birmingham B15 2TT, England), “Buckling of rectangular mindlin plates”, Computers & Structures, Vol. 15, No. 4, 1982, pp. 461-471, doi:10.1016/0045-7949(82)90081-5
ABSTRACT: The elastic buckling of rectangular Mindlin plates is considered using two related methods of analysis. These methods are the Rayleight-Ritz method and one of its piece-wise forms, the finite strip method. Arbitrary combinations of the standard boundary conditions of clamped, simply-supported and free edges are accommodated by the use in the assumed displacement fields of the normal modes of vibration of Timoshenko beams. The applied membrane stress field leading to buckling can comprise biaxial direct stress plus shear stress. A range of numerical applications is described for isotropic and transversely isotropic plates of thin and

moderately thick geometry. The results obtained using the two methods compare closely to one another and to other published results where these are available. A direct relationship between unidirectional buckling stress and frequency of vibration is demonstrated for a category of plates having one pair of opposite edges simply supported.

D. J. Dawe and I. R. Morris (Department of Civil Engineering, University of Birmingham, Birmingham B15 2TT, England), "Vibration of curved plate assemblies subjected to membrane stresses", Journal of Sound and Vibration, Vol. 81, No. 2, March 1982, pp. 229-237, doi:10.1016/0022-460X(82)90206-1
ABSTRACT: In a previous paper [1] the finite strip method was applied to the prediction of the natural frequencies of vibration of longitudinally invariant, rigidly connected assemblies of circularly curved and flat strips having diaphragm end supports. This work is extended here to include the presence of an initial membrane stress field. An individual curved strip may be subjected to a biaxial direct stress field comprising a uniform stress acting in the circumferential direction and a non-uniform stress acting in the longitudinal direction. The presence of the membrane stress field is accommodated in the analysis by the inclusion of an initial stress or geometric stiffness matrix. A further extension included here is a facility to delete in-surface inertia terms. Results are presented for the application of the strip method in predicting the frequencies of vibration of a circular cylinder subjected to a complicated membrane stress system.

O.L. Roufaeil and D.J. Dawe (Department of Civil Engineering, University of Birmingham, Birmingham B15 2TT, England), "Rayleigh-Ritz vibration analysis of rectangular Mindlin plates subjected to membrane stresses", Journal of Sound and Vibration, Vol. 85, No. 2, November 1982, pp. 263-275, doi:10.1016/0022-460X(82)90521-1
ABSTRACT: A previously developed analysis of the flexural vibration of isotropic rectangular plates is extended to include the presence of a membrane stress system. The method of analysis is the Rayleigh-Ritz method and Mindlin plate theory is used which takes into account effects which are disregarded in the classical plate theory. As in the aforementioned earlier analysis the spatial variations of the deflection and two rotations over the plate middle surface are based on the use of Timoshenko beam functions. The membrane stress system comprises biaxial direct stress plus in-plane shearing stress and is uniform throughout the plate. Numerical results are presented for a number of types of plate and of applied stress which show the manner of variation of the frequencies of vibration as the intensity of stress changes. This manner of variation is similar in form to that demonstrated elsewhere by analyses based on the use of the classical plate theory but the magnitudes of the present calculated frequencies are considerably reduced for moderately thick plates.

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"Vibration of shear-deformable laminated plate structures by the finite strip method", Computers & Structures, Vol. 27, No. 1, 1987, pp. 61-72, doi:10.1016/0045-7949(87)90181-7
ABSTRACT: Free vibration of prismatic plate structures of laminated composite material and having diaphragm end supports is considered using the finite strip method. Description is given of the development of stiffness and mass matrices for both out-of-plane and in-plane deformation of a family of strip models. The former deformation is based on first-order shear deformation plate theory, rather than classical plate theory. Frequency calculations are made using full sets of structure equations and using reduced sets obtained from an

economisation procedure. Presented results demonstrate the good convergence characteristics of the finite strip approach and reveal the relative efficiency of particular economisation schemes. Comparison made with results based on the use of classical plate theory in deriving out-of-plane strip properties shows that the effects of through-thickness shear and rotary inertia on a natural frequency are heavily dependent upon the nature of the associated mode shape.

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"Buckling and vibration of shear deformable prismatic plate structures by a complex finite strip method",
International Journal of Mechanical Sciences, Vol. 30, No. 2, 1988, pp. 77-99,
doi:10.1016/0020-7403(88)90063-X
ABSTRACT: A finite strip method is presented for the determination of buckling stresses and natural frequencies of vibration of prismatic plate structures assembled from plate flats, which generally are laminates of fibre-reinforced composite material. The finite strip method is of the single-term type, corresponding to the assumption of sinusoidal longitudinal spatial variation of displacement and force quantities. Anisotropic material behaviour and applied in-plane shear stress are accommodated by expressing the strip displacement field in terms of complex quantities. The out-of-plane properties of plate flats are based upon the use of first-order shear deformation plate theory. A family of finite strip models is described and a sub-structuring procedure is utilised to reduce the size of the eigenvalue problem. Presented numerical results reveal the high accuracy and good convergence characteristics of the method, as well as indicating the influence of through-thickness shear effects in a range of circumstances.

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"A buckling analysis capability for use in the design of composite prismatic plate structures",
Composite Structures, Vol. 16, Nos. 1-3, 1990, pp. 33-63, Special Issue: Optimum Design of Composite Structures,
doi:10.1016/0263-8223(90)90066-N
ABSTRACT: The prediction of the buckling stresses of prismatic plate structures made of composite laminated material is considered. Recent developments which have provided an extended capability in the finite strip analysis of such structures are brought together and discussed. Different analysis procedures are described, dependent upon whether the plate structure is of finite length, with diaphragm ends, or is 'long', and on whether first-order shear deformation plate theory or classical plate theory is used in developing out-of-plane strip properties. Features of the analysis include a very general description of laminate material properties, the presence of applied shear stress, the accommodation of eccentric connections between plate flats and the use of multi-level substructuring techniques, including the so-called superstrip concept. The associated computer software is used to examine the buckling behaviour of two types of panel, with attention paid to the influence of through-thickness shear deformation and of bending-stretching material coupling in unsymmetric laminates.

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"Buckling and vibration of long plate structures by complex finite strip methods", International Journal of Mechanical Sciences, Vol. 32, No. 9, 1990, pp. 743-766, doi:10.1016/0020-7403(90)90026-F
ABSTRACT: Finite strip methods are presented for the prediction of buckling stresses and natural frequencies of vibration of "long" prismatic plate structures which may be formed of fibre-reinforced, composite, laminated material with very general properties. The finite strip methods are of the single-term type with complex algebra employed to accommodate applied in-plane shear stress and anisotropic material behaviour. The developments, described here follow on very directly from an earlier paper in this Journal ([1] Dawe and Craig, Int. J. Mech. Sci.30, 77, 1988) to which frequent reference is made herein. The first development is the introduction of major improvements and extensions on the earlier work [1] which is based upon the use of first-order shear deformation plate theory to represent the out-of-plane properties of plate flats: the chief advance involves the use of multi-level substructuring procedures, including the introduction of so-called superstrips, but eccentric connections of component plates at their junctions is also included. The second development is the introduction of a new finite strip analysis which is based on the use of classical plate theory and which is complementary to the shear deformation analysis, with similar advanced features. Two computer programs, BAVPAS and BAVPAC, are introduced and description is given of some results of the application of these programs.

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"Buckling and vibration of thin laminated composite, prismatic shell structures", Composite Structures, Vol. 25, Nos. 1-4, 1993, pp. 353-362, doi:10.1016/0263-8223(93)90182-P
ABSTRACT: A description is given of the multi-term, finite strip analysis of the free vibration and buckling, under a system of applied biaxial direct and shear stresses, of thin, prismatic shell structures. The walls of the structure may be composite laminates with a general lay-up. The analysis is based on the use of Koiter-Sanders thin shell theory. Combinations of diaphragm, clamped and free conditions at the two ends of a structure are incorporated. The displacement field of a transversely-curved finite strip utilises Bernoulli-Euler beam functions in the longitudinal direction and quintic polynomial representations in the circumferential direction. The superstrip concept is used in conjunction with the modified Sturm sequence-bisection approach to provide an efficient analysis capability. Several applications involving flat plates, curved plates and complete cylinders are detailed.

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"Finite strip vibration analysis of composite prismatic shell structures with diaphragm ends", Computers & Structures, Vol. 49, No. 5, December 1993, pp. 753-765, doi:10.1016/0045-7949(93)90024-8
ABSTRACT: The finite strip method is developed for the free vibration analysis of prismatic shell structures having diaphragm end supports. In general the structure is made up of rigidly-connected, circularly-curved and flat plates which are composite laminates with a broad range of material properties, including bending—stretching coupling and anisotropy. The analysis is developed in two ways, based in turn on the use

of first-order shear deformation shell theory and of thin shell theory. The finite strip approach is of the multi-term type and the superstrip concept is employed to produce a powerful and efficient solution capability. Results, in the form of calculated natural frequencies, are presented for a number of problems for which accurate alternative solutions exist, and close comparison of results verifies the present approach.

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"Finite strip post-local-buckling analysis of composite prismatic plate structures", Computers & Structures, Vol. 48, No. 6, September 1993, pp. 1011-1023, doi:10.1016/0045-7949(93)90436-H
ABSTRACT: A finite strip method is described for the analysis of the geometrically non-linear elastic response of composite laminated, orthotropic prismatic plate structures subjected to progressive uniform end shortening. Attention is restricted to local buckling/post-buckling behaviour so that certain simplifying assumptions related to the insignificance of movements of plate junctions can be invoked. Analyses are based on the use of both classical plate theory and first-order shear deformation plate theory and a range of finite strip models is available for use in the contexts of each of these plate theories. A description is given of a number of applications involving the post-local-buckling behaviour of box sections and top-hat-stiffened and blade-stiffened panels. In one application considering a laminated box section, results are generated using a commercial finite element package and these are seen to compare closely with the predictions of the presented finite strip method.

D. J. Dawe and S. Wang (School of Civil Engineering, The University of Birmingham, Edgbaston, Birmingham B15 2TT, U.K.), "Spline finite strip analysis of the buckling and vibration of rectangular composite laminated plates", International Journal of Mechanical Sciences, Vol. 37, No. 6, June 1995, pp. 645-667, doi:10.1016/0020-7403(94)00086-Y
ABSTRACT: A spline finite strip capability is presented for predicting the buckling stresses and natural frequencies of rectangular laminated plates. The plates may have arbitrary lay-ups and general boundary conditions. The spline finite strip method is first developed in the context of first-order shear deformation plate theory and then, by reduction, the method is also developed in the context of classical plate theory. In both approaches the superstrip concept is incorporated into the solution procedure. A considerable range of types of application is described and it is demonstrated that the spline finite strip method is versatile, with good convergence characteristics and accuracy. In these applications, frequent comparison is made with the results of other approaches which comprise a spline Rayleigh-Ritz method, a finite element method, an analytical Rayleigh-Ritz method and a semi-analytical finite strip method.

Dongyao Tan and D. J. Dawe (School of Civil Engineering, The University of Birmingham, Edgbaston, Birmingham, B15 2TT, UK), "Buckling and vibration analysis of composite laminated plates and shells using general spline function", Composite Structures, Vol. 40, No. 1, December 1997, pp. 25-42, doi:10.1016/S0263-8223(97)00147-5
ABSTRACT: A general spline finite strip capability is presented for predicting the buckling stresses and natural frequencies of composite laminated plates and shells which may have arbitrary lay-ups and any boundary conditions. This method is developed in the context of first-order shear deformation plate and shell theory as well as the classical plate and shell theory and the massive substructuring technique is incorporated into the

solution procedure. A notable feature of the present capability is that the general spline integrations are carried out analytically by representing the basis general spline functions as a linear combination of cardinal spline functions. A considerable range of types of application is described and it is demonstrated that the general spline finite strip method is versatile and has more advantages over the usual equal spline finite strip method is on the buckling and vibration problems that have localized mode shapes.

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"Buckling and vibration analysis of composite plate and shell structures using the PASSAS software package", Composite Structures, Vol. 38, Nos. 1-4, May-August 1997, pp. 541-551, Special Issue: Ninth International Conference on Composite Structures, doi:10.1016/S0263-8223(97)00090-1
ABSTRACT: A description is given of the PASSAS finite strip software package for predicting the buckling stresses and natural frequencies of composite laminated prismatic plate and shell structures of complicated cross-section and general lamination. The basic equations underpinning the development of the properties of a transversely curved finite strip are presented in the context of first-order shear-deformation shell theory and, by reduction, in the context of thin shell theory. The B-spline finite strip method is used and this enables the specification of a wide range of end conditions. The major features of the software package are described, and these include a range of strip models, the use of multi-level substructuring techniques across the structure, including superstrips, and the use of an efficient and reliable solution procedure. Results are presented of the application of PASSAS to the solution of a small number of shell buckling and vibration problems.

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"Spline finite strip analysis of the buckling and vibration of composite prismatic plate structures", International Journal of Mechanical Sciences, Vol. 39, No. 10, October 1997, pp. 1161-1180, doi:10.1016/S0020-7403(97)00011-8
ABSTRACT: A spline finite strip capability is described for predicting the buckling stresses and natural frequencies of vibration of prismatic plate structures which may be of composite laminated construction with arbitrary lay-ups. The plate structures may have general boundary conditions. The capability embraces analyses based on the use of first-order shear deformation plate theory and of classical plate theory, and utilizes substructuring procedures which include the use of superstrips. The theoretical development is not detailed since the present paper reports a very direct extension of a theoretical study developed for the analysis of single plates in an earlier paper in this Journal. A considerable range of buckling and vibration applications is documented and comparison of spline finite strip numerical values of buckling stresses and frequencies is made with results generated using the semi-analytical finite strip method and, in some cases, the finite element method. Buckled and vibrational mode shapes are presented for some applications.

Dongyao Tan and D. J. Dawe (School of Civil Engineering, The University of Birmingham, Edgbaston, Birmingham B15 2TT, UK), "General spline finite strip analysis for buckling and vibration of prismatic composite laminated plate and shell structures", Composites Part B: Engineering, Vol. 29, No. 4, 1998, pp. 377-

389, doi:10.1016/S1359-8368(97)00046-2
ABSTRACT: A general spline finite strip capability is presented for predicting the buckling stresses and natural frequencies of prismatic plate and shell structures which are composed of composite laminated plate and/or shell panels that may have arbitrary lay-ups. The prismatic structures may have general cross-sections and boundary conditions. This method is developed in the context of first-order shear deformation plate and shell theory as well as the classical plate and shell theory and a massive substructuring technique is incorporated into the solution procedure. A considerable range of types of application is described and a particularly interesting one shows that the general spline finite strip capability has great flexibility in matching the boundary conditions specified on the entire structures.

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"Buckling of composite shell structures using the spline finite strip method", Composites Part B: Engineering, Vol. 30, No. 4, June 1999, pp. 351-364, doi:10.1016/S1359-8368(99)00005-0
ABSTRACT: The development of an analysis capability for predicting the buckling stresses of composite laminated, prismatic shell structures is described. The basis of the capability is the spline finite strip method, which is presented in the contexts of both first-order shear deformation shell theory and thin shell theory. The structures considered might have arbitrary lamination and general boundary conditions, and the applied stress field in any component flat or curved plate may include shear stress as well as biaxial direct stresses. Multi-level substructuring procedures are used in an efficient solution procedure. The analysis capability is incorporated into a computer software package called PASSAS and selected applications using this package are presented to show the scope and power of the new capability.

D. J. Dawe and Y. S. Ge (School of Civil Engineering, The University of Birmingham, Edgbaston, Birmingham B15 2TT, UK), "Thermal buckling of shear-deformable composite laminated plates by the spline finite strip method", Computer Methods in Applied Mechanics and Engineering, Vol. 185, Nos. 2-4, May 2000, pp. 347-366, doi:10.1016/S0045-7825(99)00266-2
ABSTRACT: Description is given of the development of the spline finite strip method for predicting the critical buckling temperatures of rectangular composite laminated plates. The analysis takes place in two distinct parts, namely an in-plane thermal stress analysis in the pre-buckling stage followed by a buckling analysis using the determined in-plane stress distribution. The buckling analysis takes place in the context of first-order shear deformation plate theory. The permitted lay-up of the laminates is quite general, within the constraint that the plate remains flat prior to buckling, and the boundary conditions are versatile. The distribution of temperature can be non-uniform in the plane of the plate. A range of applications of the developed procedure is presented and numerous comparisons are made with the results of previous studies. The spline finite strip method is shown to be versatile and accurate, with good convergence characteristics.

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"Nonlinear transient analysis of rectangular composite laminated plates", Composite Structures, Vol. 49, No. 2, June 2000, pp. 129-139, doi:10.1016/S0263-8223(99)00108-7
ABSTRACT: The semi-analytical finite strip method is developed for the analysis of the geometrically nonlinear response to dynamic loading of rectangular composite laminated plates. The plates have simply supported ends and their properties are evaluated in the context of first-order shear deformation plate theory. The applied loading acts normal to the plate surface but otherwise may be of a general nature with respect to space and time. Solution to the nonlinear dynamic problem is obtained through use of the Newmark time-stepping scheme in association with Newton–Raphson iteration. Applications are described which relate to isotropic and orthotropic plates, and to laminates. In general a close comparison is demonstrated between the predictions of the developed finite strip approach and those of a finite element method.

Y. Ge, W. Yuan and D.J. Dawe (School of Engineering, The University of Birmingham, Birmingham B15 2TT, UK), "Thermomechanical postbuckling of composite laminated plates by the spline finite strip method", Composite Structures, Vol. 71, No. 1, October 2005, pp. 115-129, doi:10.1016/j.compstruct.2004.12.003
ABSTRACT: The thermomechanical postbuckling behaviour of composite laminated plates is studied with the aid of the B-spline finite strip method under the combination of temperature load and applied uniaxial mechanical stress. To account for through-thickness shear deformation effects, the thermal-elastic, first-order shear deformation (Reissner–Mindlin) plate theory is used in this paper. General boundary conditions and laminate lay-ups can be accommodated in the newly developed finite strip approach. A range of applications is described and the results generated by the finite strip procedure are compared with the results of previous studies. The spline finite strip method is shown to be versatile and accurate with good convergence qualities.

Dawe, D. J. and Yuan, W. X., "Overall and Local Buckling of Sandwich Plates with Laminated Faceplates, Part I: Analysis," Computer Methods in Applied Mechanics and Engineering, Vol. 190, 2001, pp. 5197-5213.

Yuan, W. X. and Dawe, D. J., "Overall and Local Buckling of Sandwich Plates with Laminated Faceplates, Part II: Applications, "Computer Methods in Applied Mechanics and Engineering, Vol. 190, 2001, pp. 5215-5231.