Advances in Computational Stability Analysis

The basket for a spent fuel shipping cask is subjected to compressive stresses that may cause global instability of the basket assemblies or local buckling of the individual members. Adopting the common buckling design practice in which the stability capacity of the entire structure is based on the performance of the individual members of the assemblies, the typical spent fuel basket, which is composed of plates and tubular structural members, can be idealized as an assemblage of columns, beam-columns and plates. This report presents the flexural buckling formulas for five load cases that are common in the basket buckling analysis: column under axial loads, column under axial and bending loads, plate under uniaxial loads, plate under biaxial loadings, and plate under biaxial loads and lateral pressure. The acceptance criteria from the ASME Boiler and Pressure Vessel Code are used to determine the adequacy of the basket components. Special acceptance criteria are proposed to address the unique material characteristics of austenitic stainless steel, a material which is frequently used in the basket assemblies.
Computerized buckling analysis of shells. A crucial element of structural and continuum mechanics, stability theory has limitless applications in civil, mechanical, aerospace, naval and nuclear engineering. This text of unparalleled scope presents a comprehensive exposition of the principles and applications of stability analysis. It has been proven as a text for introductory courses and various advanced courses for graduate students. It is also prized as an exhaustive reference for engineers and researchers. The authors' focus on understanding of the basic principles rather than excessive detailed solutions, and their treatment of each subject proceed from simple examples to general concepts and rigorous formulations. All the results are derived using as simple mathematics as possible. Numerous examples are given and 700 exercise problems help in attaining a firm grasp of this central aspect of solid mechanics. The book is an unabridged republication of the 1991 edition by Oxford University Press and the 2003 edition by Dover, updated with 18 pages of end notes.

Buckling of Inhomogeneous and Functionally Graded Columns

Computerized Buckling Analysis of Shells An analysis and sample results for the lateral buckling and vibration of a compressively loaded column is presented whose cross section is piecewise constant along its length. The column is symmetric about its mid-span and consists of three sections, the center section having a stiffer cross section than the two identical end sections. Buckling and vibration characteristics of the column are determined from numerical solution of the exact eigenvalue problems. Parametric structural efficiency analyses are performed using a nondimensionalized set of governing equations to determine the optimum ratio between the lengths of the center section and the outer sections based on both buckling load and vibration frequency requirements. In these analyses, two relationships exist. One is between cross-sectional mass and the cross section, and the other is a high-efficiency scheme. The effect of axial load on vibration frequency is also examined and compared with that of a uniform column. Lake, Mark S. and Mikulas, Martin M., Jr. Langley Research Center NASA-TP-3090, L-16854, NAS 1.60:3090 RTOP 506-43-41-02

Analysis of the Column Buckling A previous analysis of the creep behavior of a slightly curved pin-headed section column under constant load is extended to the slightly curved solid rectangular-section column. The analysis leads to a differential equation for the plastic strains at the midheight cross section. The form of the equation indicates the significant parameters which may be useful in plotting test data on the creep life of columns. These are a lifetime parameter, an initial-straightness parameter, and the ratio of the average applied stress to the Euler stress. A numerical method of solving the differential equation, suitable for use with a high-speed digital computer, is described, and although not evident from the differential equation, is argued intuitively and confirmed by the numerical computations.

Buckling and Vibration Analysis of a Simply Supported Column with a Piecewise Constant Cross Section

Accuracy of Beam-column Theory for Post-buckling Analysis of Pinned-pinned Axially Restrained Columns Subjected to Uniform Temperature Increase In the work performed to date on the problem of developing a plate buckling analysis capable of coping with the problems of elastic boundary constraints, thermal gradients, geometrically irregular boundaries, etc., a generally applicable buckling analysis approach has been developed and applied to columns. In the belief that this
procedure could be of some practical usefulness in its application to column
problems, the method and its application to several simple problems are presented
herein. In addition, the results offer some interesting insights into column behavior
which do not appear to be generally appreciated. (Author).

Computerized buckling analysis of shells The study of buckling loads, which often
hinges on numerical methods, is key in designing structural elements. But the need
for analytical solutions in addition to numerical methods is what drove the creation of
Exact Solutions for Buckling of Structural Members. It allows readers to assess the
reliability and accuracy of solutions obtained by nume

NUREG/CR. Thin shells are very popular structures in many different branches of
engineering. There are the domes, water and cooling towers, the contain ments in civil
engineering, the pressure vessels and pipes in mechanical and nuclear engineering,
storage tanks and platform components in marine and offshore engineering, the car
bodies in the automobile industry, planes, rockets and space structures in
aeronautical engineering, to mention only a few examples of the broad spectrum of
application. In addition there is the large applied mechanics group involved in all the
computational and experimental work in this area. Thin shells are in a way optimal
structures. They play the role of the "primadonnas" among all kinds of structures.
Their performance can be extraordinary, but they can also be very sensitive. The
susceptibility to buckling is a typical example. David Bushnell says in his recent
review paper entitled "Buckling of Shells - Pitfall for DeSigners": "To the layman
buckling is a mysterious, perhaps even awe inspiring phenomenon that transforms
objects originally imbued with symmetrical beauty into junk".

Buckling and Vibration Analysis of a Simply Supported Column with a Piecewise
Constant Cross Section

Dynamic, Inelastic Bucking Analysis of Mark I Torus Support Columns A flambagem
das armaduras longitudinais em pilares de concreto armadopode ocorrer na região
entre dois estribos consecutivos, ou pode envolver um certo número de estribos. As
normas de projeto existentes não fornecem umametodologia apropriada para o
dimensionamento dos estribos em diferentessituações. O presente trabalho tem por
objetivo desenvolver uma formulação quepermita analisar a flambagem das
armaduras longitudinais em pilares de concretoarmado submetidos a carregamento
axial levando em conta o espaçamento entreos estribos, o diâmetro e arranjo dos
estribos na seção transversal e o diâmetro dasarmaduras longitudinais. Para este
propósito um método analítico para a avaliação da flambagem da armadura
longitudinal é proposto, considerando-se as barraslongitudinais restringidas pela
rigidez axial ou à flexão dos estribos. A dmite-seque a armadura longitudinal funciona
como uma coluna esbelta. Consideram-seduas formas de modelagem da atuação dos
estribos: como apoios elásticosdiscretos e como base elástica contínua. O presente
trabalho trata a coluna comum ou mais modos de deformação, incluindo certas não-
linearidades. São fornecidos cargas críticas e caminhos pós-criticos para tais casos.
Como resultado deste estudo, apresenta-se uma proposta para dimensionamento
racional doestribos que permite estudar diferentes alternativas em um ábaco de
utilizaçõesimples para projeto. A presentam-se comparações com resultados
experimentaisda literatura em pilares de concreto armado. Isto permite uma avaliação
critica dosdesenvolvimentos teóricos realizados e da forma proposta de
dimensionamentoracional dos estribos.
Viscoelastic Buckling Analysis of Laminated Composite Columns Research Paper from the year 2013 in the subject Physics - Mechanics, grade: 3.70, University of Weimar, language: English, abstract: In this paper, two types of steel frames, steel frame without side sway permission and another with side sway permission are created in Abaqus with 10 multiple slenderness ratio of the columns by changing the length every time starting from 1 M and ending with 10 M length of the columns. Twenty models of steel frames with single story and single bay were created, the models are with the same 2D dimensions and material properties, the cross section of the steel is (0.5*0.5) M, and the supports are fixed, two equal forces P = 1000 N are exerted on the frames in the position mentioned in fig 6, a beam section was defined for the frame integrated before analysis with Young modulus of elasticity $E = 1 \times 10^7$ N/M², and shear modulus $G = 3.8 \times 10^6$ N/M² and poisons ratio $\nu = 0.3$. A linear perturbation step is created for buckling and 10 eigenvalues are requested for analysis, a standard quadratic beam element type is generated with global seeding of 0.6, and 20 Jobs are created for every situation and conclusions have been obtained, the critical buckling loads of the frames fall in the ranges between the Euler loads forms which has been proved for each type of frames and this scientific approach was verified in this research, in addition to that the relation between the length of the column and the eigenvalues that represent the critical loads of buckling verified, and the simulations of the mode shapes of buckling of the steel frames were identified adopting finite element analysis which shows the amount of loads necessary to reach each mode shape of buckling for each type of steel frames mentioned before.

Guide to Stability Design Criteria for Metal Structures

Structural Stability of Steel

Exact Solutions for Buckling of Structural Members A linear viscoelastic buckling analysis for laminated composite columns was developed using the quasi-elastic approach. The analysis includes transverse shear deformation (TSD), transverse normal deformation (TND), and bending-extensional coupling. The Rayleigh-Ritz method of solution was employed to solve the governing equation derived from the Theorem of Minimum Potential Energy. Viscoelastic column buckling behavior was investigated for four laminate configurations, $[0]_2$, $[0/\pm 45/0]_3$, $[0/\pm 45/90]_3$, and for column length-to-thickness ratios ($l/t$) ranging between 35.8 and 150.0. The results for graphite/epoxy show that viscoelastic effects are significant, reducing the critical buckling load by 10% to 20%, depending upon laminate configuration. For geometries where TSD is important ($l/t$)

A Finite Element Analysis of the Elastic Behavior of Beam Columns The current trend of building more streamlined structures has made stability analysis a subject of extreme importance. It is mostly a safety issue because Stability loss could result in an unimaginable catastrophe. Written by two authors with a combined 80 years of professional and academic experience, the objective of Stability of Structures: Principles and Applications is to provide engineers and architects with a firm grasp of the fundamentals and principles that are essential to performing effective stability analysts. Concise and readable, this guide presents stability analysis within the context of elementary nonlinear flexural analysis, providing a strong foundation for incorporating theory into everyday practice. The first chapter introduces the buckling of columns. It begins with the linear elastic theory and proceeds to include the effects of large deformations and inelastic behavior. In Chapter 2 various approximate
methods are illustrated along with the fundamentals of energy methods. The chapter concludes by introducing several special topics, some advanced, that are useful in understanding the physical resistance mechanisms and consistent and rigorous mathematical analysis. Chapters 3 and 4 cover buckling of beam-columns. Chapter 5 presents torsion in structures in some detail, which is one of the least well understood subjects in the entire spectrum of structural mechanics. Strictly speaking, torsion itself does not belong to a topic in structural stability, but needs to be covered to some extent for a better understanding of buckling accompanied with torsional behavior. Chapters 6 and 7 consider stability of framed structures in conjunction with torsional behavior of structures. Chapters 8 to 10 consider buckling of plate elements, cylindrical shells, and general shells. Although the book is primarily devoted to analysis, rudimentary design aspects are discussed. Balanced presentation for both theory and practice. Well-blended content covering elementary to advanced topics. Detailed presentation of the development.

Stability and Dynamic Analysis of a Slender Column with Curved Longitudinal Stiffeners

Bifurcation and Buckling in Structures Futures in Mechanics of Structures and Materials is a collection of peer-reviewed papers presented at the 20th Australian Conference on the Mechanics of Structures and Materials (ACMSM 20, University of Southern Queensland, Toowoomba, Queensland, Australia, 2 - 5 December 2008) by academics, researchers and practicing engineers mainly from Australia.

Dynamic Buckling of Columns

This book is the Proceedings of a State-of-the-Art Workshop on Connections and the Behaviour, Strength and Design of Steel Structures held at Laboratoire de Mecanique et Technologie, Ecole Normale, Cachan, France from 25th to 27th May, 1987. It contains the papers presented at the above proceedings and is split into eight main sections covering: Local Analysis of Joints, Mathematical Models, Classification, Frame Analysis, Frame Stability and Simplified Methods, Design Requirements, Data Base Organisation, Research and Development Needs. With papers from 50 international contributors, this text will provide essential reading for all those involved with steel structures.

Column Buckling Analysis of Wood Stud Members Due to Reduced Stiffness Over Partial Member Lengths

Buckling analysis of longitudinal reinforcement in concrete columns. Highlights of the book: Discussion about all the fields of Computer Aided Engineering, Finite Element Analysis. Sharing of worldwide experience by more than 10 working professionals. Emphasis on practical usage and minimum mathematics. Simple language, more than 1000 colour images. International quality printing on specially imported paper. Why this book has been written: FEA is gaining popularity day by day & is a sought after dream career for mechanical engineers. Enthusiastic engineers and managers who want to refresh or update the knowledge on FEA are encountered with volume of published books. Often professionals realize that they are not in touch with theoretical concepts & being pre-requisite and find it too mathematical and Hi-Fi. Many a times these books just end up being decoration in their bookshelves. All the authors of this book are from IITs & IISc and after joining the industry realized the gap between university education and the practical FEA. Over the years they learned it via interaction with experts from international community, sharing experience with...
each other and hard route of trial & error method. The basic aim of this book is to share the knowledge & practices used in the industry with experienced and in particular beginners so as to reduce the learning curve & avoid reinvention of the cycle. Emphasis is on simple language, practical usage, minimum mathematics & no pre-requisites. All basic concepts of engineering are included as & where it is required. It is hoped that this book would be helpful to beginners, experienced users, managers, group leaders and as additional reading material for university courses.

Buckling Analysis of Column Spring Systems Using the Kollár Conjecture The nonlinear problem of the asymmetric snap-through buckling of a cantilever column that is restrained at its tip by a stiff, inclined wire, and loaded laterally by a tip force, admits an exact solution which was determined previously. The structure was found to be imperfection-sensitive if one considers combined extensional stiffnesses of the wire and of the column centerline to play the role of an imperfection. The same problem is now solved using the general Koiter method of analysis for the near post-buckling equilibrium. This present result for the post-buckling load vs. deflection relation for the 'perfect structure' (infinite extensional stiffnesses) is shown to be an asymptotic representation of the corresponding exact result for vanishingly small deflection. At positive deflection, the approximate values for load in the asymptotic representation are less than the exact values. A similar conclusion is drawn for the buckling load vs. imperfection amplitude relation for the imperfect structure (finite extensional stiffnesses). (Author).

Futures in Mechanics of Structures and Materials This report describes the work performed by Lockheed Palo Alto Research Laboratory, Palo Alto, California 94304. The work was sponsored by Air Force Office of Scientific Research, Bolling AFB, Washington, D. C. under Grant F49620-77-C-0122 and by the Flight Dynamics Laboratory, Air Force Wright Aeronautical Laboratories, Wright-Patterson AFB, Ohio under Contract F33615-76-C-3105. The work was completed under Task 2307N1, "Basic Research in Behavior of Metallic and Composite Components of Airframe Structures". The work was administered by Lt. Col. J. D. Morgan (AFOSR) and Dr. N. S. Khot (AFWAL/FIBRA). The contract work was performed between October 1977 and December 1980. The technical report was released by the Author in December 1981.

Preface Many structures are assembled from parts which are thin. For example, a stiffened plate or cylindrical panel is composed of a sheet the thickness of which is small compared to its length, breadth, and stiffener-spacing, and stiffeners the thickness of which is small compared to their heights and lengths. These assembled structures, loaded in compression, can buckle overall, that is sheet and stiffeners can collapse together in a general instability mode; the sheet can buckle locally between stiffeners; the stiffeners can cripple; and a variety of complex buckling interactions can occur involving local and overall deformations of both sheet and stiffeners. More complex, built-up structures can buckle in more complex and subtle ways.

Buckling Analysis of Spent Fuel Basket This work on structural stability has been written primarily as a textbook to provide a clear understanding of theoretical stability behaviour. It will give readers a basic understanding of the design specifications developed by, for example, AISC, and implemented in building codes by IBC.

Connections in Steel Structures

Finite element analysis of the buckling critical loads in un-braced steel frames with
Buckling Analysis of Column In Abaqus

multiple slenderness ratio configurations

Buckling of Shells Experimental results of dynamic buckling tests of columns in which plastic deformation was expected to occur are given. The tests were performed in the same range of the dynamic similarity number as those at Polytechnic Institute of Brooklyn; however the similarity numbers were obtained with shorter columns and higher loading velocities to accommodate shorter columns and to provide more rigidity and reliability. As a consequence any components of the mechanical part and nearly the whole electrical part of the machine have been redesigned and new methods in recording were used.

Buckling of Structures

Buckling Analysis of Timoshenko Beam/column "Buckling is an instability encountered in a wide variety of problems, both in engineering and biology. Almost all engineering structures are designed with adequate safety factors to prevent failure due to buckling, yielding, or dynamic loads. In a classical sense, design for buckling is done by carefully controlling the modulus of elasticity, moment of inertia, and the length of the structure. Further, such an approach assumes the material to be homogeneous and does not generally account for the microstructural details of the column. In the first part of this thesis, we study the buckling of inhomogeneous columns with a two-phase checkerboard microstructure. Monte Carlo simulations are used to generate microstructures with arbitrary volume fractions and phase contrasts (ratio of the modulus of individual phases). An analytical form is obtained for the ensemble averaged critical buckling load based on the results of over 18,000 eigenvalue problems at arbitrary volume fractions, phase contrasts, and distributions. Further, microstructural realizations that correspond to the highest buckling load (best design) and the lowest buckling load (worst design) are identified and the corresponding distribution of individual phases is determined. The statistical nature of the critical buckling load is discussed by computing the statistical moments that include the mean, coefficient of variation, skewness, and kurtosis. Next, we consider the buckling of long and slender columns with functionally graded microstructure. In such columns, the modulus of elasticity and/or the moment of inertia is varied in a controlled manner along the length of the column. The primary objective is to identify functionally graded microstructures that maximize (and minimize) the critical buckling load when compared to a reference homogeneous column. Several columns with a variety of microstructures are examined and a constraint is imposed on each of the microstructures so that the volume averaged elastic modulus remains the same in all the columns. The buckling load capacity of these microstructures is determined using linear perturbation analysis, as well as the Rayleigh-Ritz method. Finally, microstructures that maximize the critical buckling load are identified and a relationship between the material distribution and the corresponding buckling mode shape is established."

Abstract.

Stability of Structures Bifurcation and Buckling in Structures describes the theory and analysis of bifurcation and buckling in structures. Emphasis is placed on a general procedure for solving nonlinear governing equations and an analysis procedure related to the finite-element method. Simple structural examples using trusses, columns, and frames illustrate the principles. Part I presents fundamental issues such as the general mathematical framework for bifurcation and buckling, procedures for
the buckling load/mode analyses, and numerical analysis procedures to trace the solution curves and switch to bifurcation solutions. Advanced topics include asymptotic theory of bifurcation and bifurcation theory of symmetric systems. Part II deals with buckling of perfect and imperfect structures. An overview of the member buckling of columns and beams is provided, followed by the buckling analysis of truss and frame structures. The worst and random imperfections are studied as advanced topics. An extensive review of the history of buckling is presented. This text is ideal for advanced undergraduate and graduate students in engineering and applied mathematics. To assist readers, problems are listed at the end of each chapter, and their answers are given at the end of the book. Kiyohiro Ikeda is Professor Emeritus at Tohoku University, Japan. Kazuo Murota is a Project Professor at the Institute of Statistical Mathematics, Japan, as well as Professor Emeritus at the University of Tokyo, Kyoto University, and Tokyo Metropolitan University, Japan.

Creep-buckling Analysis of Rectangular-section Columns This volume contains the written texts of the papers presented at a Symposium on Buckling of Structures held at Harvard University in June 1974. This symposium, one of several on various topics sponsored annually by the International Union of Theoretical and Applied Mechanics (IUTAM), was organized by a Scientific Committee consisting of B. Budiansky (Chairman), A. H. Chilver, W. T. Koiter, and A. S. Vol' mir. Participation was by invitation of the Scientific Committee, and specific lecturers were invited to speak in the areas of experimental research, buckling and post-buckling calculations, post-buckling mode interaction, plasticity and creep effects, dynamic buckling, stochastic problems, and design. A total of 29 lectures were delivered, including a general opening lecture by Professor Koiter, and there were 93 registered participants from 16 different countries. Financial support for the symposium was provided by IUTAM, in the form of partial travel support for a number of participants, and also by the National Science Foundation, the National Aeronautics and Space Administration, and the Air Force Office of Scientific Research, for additional travel support and administrative expenses. Meeting facilities and services were efficiently provided by the Science Center of Harvard University, and administrative support was generously provided by the Division of Engineering and Applied Physics of Harvard University. The scientific chairman enjoyed the invaluable assistance of his colleagues Professors J. W. Hutchinson and J. L.

Post-buckling Analysis of an Elastically-restrained Column

Buckling Analysis of a Composite Column Finite Element Analysis Method Using I-DEAS This book provides simplified and refined procedures applicable to design and to accessing design limitations and offers guidance to design specifications, codes and standards currently applied to the stability of metal structures.

Analysis of Column Cross Section Towards Buckling Analysis Using Civilfem with Ansys Software

Buckling Strength of Metal Structures

Stability of Structures Stability is a basic concern in both design and analysis of load-carrying systems and constitutes a major topic in the field of engineering science and mechanics. Since structural instability may lead to catastrophic failure of engineering structures, stability requirements must be satisfied besides requirements related to
Acces PDF Buckling Analysis Of Column In Abaqus

Material failure. Knowledge on stability is of great importance in the areas of Civil Engineering, Mechanical Engineering and Aerospace Engineering; and all these disciplines have their own literature related to the subject. This book is intended to present state-of-the-art in the stability analysis and to bring a number of researches together exposing the advances in the field. It consists of original and innovative research studies exhibiting various investigation directions.

Practical Finite Element Analysis This report describes the work performed by Lockheed Palo Alto Research Laboratory, Palo Alto, California 94304. The work was sponsored by Air Force Office of Scientific Research, Bolling AFB, Washington, D.C. under Grant F49620-77-C-0122 and by the Flight Dynamics Laboratory, Air Force Wright Aeronautical Laboratories, Wright-Patterson AFB, Ohio under Contract F33615-76-C-3105. The work was completed under Task 230711, "Basic Research in Behavior of Metallic and Composite Components of Airframe Structures". The work was administered by Lt. Col. J. D. Morgan (AFOSR) and Dr. N. S. Khot (AFWAL/FIBRA). The contract work was performed between October 1977 and December 1980. The technical report was released by the Author in December 1981.

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Crippling/column Buckling Analysis and Test of Graphite/epoxy-stiffened Panels

Buckling Analysis of Column with Trapezoid Web The design of residential structures has changed and evolved throughout years of research based on numerical modelling of real-world conditions. Wood design is controlled heavily by member use, baseline material load capacities, and wood species, all of which determine material properties. Extensive work has been done to determine the effects of altering material properties due to environmental stimuli, however, certain types of decay and wood rot have yet to be fully tested and understood. Certain microbial organisms, given the right conditions, can cause irreversible damage to wood structures. A particularly critical mode of failure is premature column collapse which is driven in part by degraded cross sectional and material properties. Using stiffness relationships smartly programmed into matrix form, it is possible to calculate reduced buckling capacities for these degraded members to draw some important conclusions. Two important items are to determine what degrees of wood decay are critical and what column heights are particularly susceptible to this type of premature failure. Finally, specifications and code should be developed further to assist engineers make choices about the criticality of wood decay without the use of personalized software. This can be done using pre-generated aids to help designers make smarter and more cost effective choices.

NASA Technical Paper