ELASTIC STABILITY OF STRUCTURES

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PRE-REQUISITES : Mechanics of Solid

INTENDED AUDIENCE : Civil & Structural Engineering/ Mechanical Engineering/Aerospace Engineering/ Naval Structures students

INDUSTRY SUPPORT : All Structural Engineering Industries. All Construction Industries like L&T, Indian Space Research Organisation (ISRO), Defence Research and Development Organisation(DRDO) , GE Mechanics and Design, National Aerospace Laboratory (NAL),Aeronautical Development Establishment(ADE), Aaerospace firms like Boeing, Airbus etc., Composite manufacturing industries.

COURSE OUTLINE :

A thorough understanding on structural stability is essential to structural engineers whose job is to design safe and economic structures. In a structure, a small change in compressive load could cause a large variation in displacement. If this change in displacement is large enough in a critical member of the structure, a local or member instability could lead to collapse of the entire structure. Instability failures is catastrophic This course explains how and under what loading condition, a structure passes from a stable state to unstable state. Different structural members and systems are analyzed for their stability. This also includes how theory translates into design methods implemented in design guidelines. All major international standard specifications include provisions based on stability theory. Attention is especially focused on metal structures. Compared to structures designed using other construction materials, metal structures rely to a greater extent on stability limit states.

ABOUT INSTRUCTOR :

Prof. Sarat Kumar Panda is currently working as an Associate Professor in the Department of Civil Engineering, IIT(ISM) Dhanbad. The above weblink provides my research details. I have taught this ‘Elastic Stability of Structures’ course four times to the PG students of IIT(ISM) Danbad and almost all occasions I have received very good overall student feedback. I have about 12 years of teaching experience at UG and PG levels combined. I have also briefly worked in industry in an applied sector. My research interests include static and dynamic instability of different structural elements including columns, plates and shells by considering geometric nonlinearity, shear deformation theories, thickness stretching etc. I have guided two PhDs in the same area of research and also have done my own PhD in the subject ‘Static and Dynamic Instability Analysis of plates and Cylindrical panels using Third-Order theory. I have also successful completed one research project in the same area of research supported by DST and another structural stability project (SPARC project) is presently ongoing which is supported by MHRD.

COURSE PLAN :

Week 1: Fundamental principles for elastic stability, Variational method in elastic problems
Week 2: Approximate methods in elasticity (Contd.), Stability of rigid body systems for one-degree-of-freedom
Week 3: Two-degree-of-freedom structural model for stability analysis, Snap-through model and model with imperfect geometry
Week 4: Eigenvalue problems for elastic buckling of columns, Buckling of columns with different end conditions
Week 5: Basic equation for stability of beam-columns, Analysis of beam-columns with different loading conditions
Week 6: Stability analysis of frames, Finite element frame work for stability analysis of frames
Week 7: Energy based methods for elastic buckling analysis, Buckling of bars on an elastic foundation
Week 8: Torsion of thin walled open cross section, Torsional buckling
Week 9: Buckling of uniformly compressed circular arch, Buckling of circular rings under uniform external pressure
Week 10: Governing differential equation of plate buckling, Buckling load of thin Rectangular Plates by energy method
Week 11: Symmetrical buckling of cylindrical shell, Governing differential equation of cylindrical shell buckling
Week 12: Nonlinear stability analysis of column, von Kármán theory of plates and shells for nonlinear analysis