

EGM 6736 - THEORY OF ELASTIC STABILITY
Common Course Syllabus

Catalog Description: 3 CREDITS. Introducing the principles and theory of structural stability and the buckling characteristics of structures such as beams, columns, thin plates, etc., and postbuckling of structures.

Goals: To introduce graduate students to the basic concepts and the state-of-the-art of static and dynamic stability of structures.

Topics:

1. Concept of stability, Lyapunov functions.
2. Stability of linear constant coefficient systems, stability of non-linear systems.
3. Buckling of columns, problems amenable to exact solution.
4. Bending in the presence of axial loading, systems under combined loading.
5. Bimodular structures, effect of shear deformation, buckling of composite columns.
6. Trefftz's criterion, Rayleigh-Ritz method, Bubnov-Galerkin method.
7. Numerical techniques: finite element method, finite difference method, convergence, differential quadrature method.
8. Static and dynamic imperfection sensitivity of structures: theories of Koiter, Budiansky and Hutchinson, small oscillations around non-linear state.
9. Non-conservative problems, statically applied follower forces, the so-called Beck's and Leipholz's columns, attempts of experimental verification, realistic problems: instability of elastic pipes conveying fluid, flutter of a plate in a gas flow.
10. Time-varying systems, Floquet's theory.
11. Complex dynamics, Lyapunov exponents.
12. Application of computerized symbolic algebra in buckling.
13. Mini-research project in buckling of structures.

Course outcomes:

1. Students will understand both static and dynamic instabilities, and both theoretical and numerical methods.
2. Students will be able to analyze simple structures that have not yet been analyzed in the literature. These original problems will demonstrate the applicability of the acquired knowledge in stability of structures.

Prepared by: I. Elishakoff - 4/01, updated 4/08