AE 6240 NUMERICAL METHODS IN STRUCTURAL DYNAMICS

LIST OF TOPICS

Rayleigh's quotient; Stodola-Vianello method (3 hours)

Rayleigh-Ritz and Galerkin's methods; dynamic response by analytical techniques (3 hours)

The algebraic eigenvalue problem: mathematical preliminaries. Similarity transformations; Orthogonality of eigenmodes; Rayleigh quotient; Minimax characterization of eigenvalues; eigenvalue separation and Sturm sequence. (3 hours)

Finite element techniques: mass and stiffness matrices. Various types of dynamic analysis: frequency response, modal analysis, and direct integration methods. (6 hours)

Forced harmonic response of structures. Dynamic influence coefficients; Spectral decomposition of dynamic influence coefficient matrix. (6 hours)

Derivation and analysis of direct integration algorithms for structural equations of motion. Concepts of stability, accuracy, and numerical dissipation. The following algorithms will be investigated: the Newmark family of algorithms, the Hilbert-Hughes-Taylor algorithm, the finite element in time approach. (9 hours)

Mathematical preliminaries to the analysis eigenvalue extraction algorithms. The following will be investigated: the Sturm sequence check, Rayleigh-Ritz analysis, error analysis. (3 hours)

Eigenvalue extraction algorithms. The following algorithms will be investigated: the vector inverse iteration method, shifting methods, the Jacobi algorithms, vector and matrix deflation. Structural modification and perturbation theory. (6 hours)

Derivation and analysis of eigenvalue extraction algorithms for large scale eigenproblems. The following algorithms will be investigated: the determinant search method, the subspace iteration method, the Lanczos algorithm, the Arnoldi Algorithm. (3 hours)

Quizzes/review (3 hours)