CE725A: Vibration-based Structural Health Monitoring for CE Applications 1.5-0-0-0 [5]

Course Contents:

Introduction to Structural Health Monitoring (SHM): NDE and SHM; Structural health management; Vibration-based techniques for SHM: Basic concepts; Diagnosis Levels; Local and global methods; Damage diagnosis as an inverse problem; Model-based damage assessment; Data-based damage assessment; Experimental and analytical examples; Damage detection using modal parameters: Formulation; Fundamental and higher mode shapes and their derivatives; Numerical illustrations; Damages at multiple locations; Damage characterization; Output-only algorithms for modal parameter extraction: Frequency domain decomposition (FDD); Natural excitation technique (NExT); Eigensystem realization algorithm; Random decrement technique (RDT); Stochastic subspace identification technique (SSID); Performance under varied signal-to-noise ratio (SNR); Time-domain damage detection methods: Kalman filters; Autoregressive model (AR) and AR with exogenous input (ARX); Damage sensitive features (DSFs); Feature selection criteria - Feature versus metric; Damage identification in non-linear systems; Extended Kalman filter; Introduction to Bayesian Model updating: Updating of the initial model, Damage localization and quantification; SHM System Design: Data Handling: Data acquisition and transmission; Processing of recorded data; Evaluate sources of variability; Modeling of environmental conditions; Consideration of soil-structure interaction; Sensor optimization; Sensitivity analysis.