

PD146
Flow Induced Vibration with Applications to Failure Analysis

Day One

- Introduction to Flow-Induced Vibration
- Dimensional analysis in fluid-structure interaction
 - Theoretical and experimental approaches to Flow-Induced Vibration analysis
 - Dimensional analysis and model scaling
 - Application to motions of a tall building in wind
- Natural Frequencies of Fluid and Structures
 - Single degree of freedom
 - Multi degree of freedom
 - Natural frequencies of Beams, plates and shells
- Forced Vibration
 - One degree of freedom spring-mass systems
 - Vibration of continuous structures:
 - Beams, plates, and shells
 - Damping and damper design
- Fluid Forces on Structures
 - Drag and added mass of structures in flow
 - Pressure and shear drag, drag coefficients, forces on cylinder in a wake
 - Added mass and coupling between structures in water and dense fluids

Day Two

- Vortices and Vortex Shedding from Stationary Structures
 - Strouhal numbers and the vortex street
 - Reynolds number effects
- Vortex Shedding from Vibrating Structures
 - Lock in and lift coefficients
 - Feedback and the motion induced changes in vortex shedding
- Prediction of Vortex-Induced Motion of Cylinder in a Flow
 - Coupled response
 - Application to stacks and off shore structures
- Reduction of Vortex-Induced Vibration in Air and Water
 - Design of strakes and dampers
- Galloping and Flutter
 - Lift and torsion on in inclined airfoils, and rectangular bodies
 - Divergence in a steady wind
 - Galloping an mixed mode phenomena
 - Application to bridge decks and vanes

Day Three

- Heat Exchanger Tube Flow-Induced Vibration
 - Tube and shell heat exchanger design and fluid dynamics
 - Fluid Forces on clusters of tubes
 - Onset of instability and tube wear
 - Application to heat exchangers in chemical and nuclear power industry
- Aeroacoustics: Sound Generation by Flow
 - Free propagation
 - Ray acoustics, SPL, and dB
 - Traveling and stationary acoustic waves in ducts and cavities
 - Heat exchanger acoustic resonance
 - Flow excitation of cavities
- Vibration Due to Internal Flow
 - Sources of acoustic energy in ducts and piping systems
 - Transmission of sound and turbulence
 - Case histories of internal flow induced vibration
 - Reduction of sound in piping
 - Thermal-acoustic excitation and internal flow instability
- Turbulence-Induced Vibration and Buffeting
 - Application of random vibration theory to turbulence
 - Calculation of spectra and structural response
 - Models for turbulence in practical systems
 - Application to process and power plants and in aerospace