

## **EL512** **The Bolted Joint**

### **Module One**

- Introduction to the Bolted Joint
  - Basic Concepts & Mechanics of Bolted Joints
  - The Challenge
  - Stress and Strength Considerations
  - Threads and Their Strength

### **Module Two**

- Materials Properties, Behavior, and Specifications
  - Properties Affecting the Clamping Force
  - Appropriate Bolt Material Standards
  - Bolting Material Properties and Materials Selection

### **Module Three**

- Stiffness and Strain Considerations
  - Bolt Stretch and Stiffness
  - Stiffness of the Joint
  - The Load factor and Some Design Goals

### **Module Four**

- Joint Diagrams, Load Factors, and Loading Planes
  - Understanding and using the Load diagram
  - Some examples
  - Tension and compression loads
  - Using the load factor

### **Module Five**

- Assembly Basics & Methods
  - Basic Considerations
  - Variables and their effects
  - Manual Torque
  - Torque and Torque Calculation (attach spreadsheet)
  - Tensioning and Turn of the Nut

### **Module Six**

- Lubrication and Tightening Patterns
  - Lubrication considerations Re Ch7
  - Recent Research
  - Circular Patterns
  - Recent pattern Research
  - Non-Circular Patterns



### **Module Seven**

- Joint Analysis Calculations
  - Overview of basic methods
  - VDI calculation method and goals
  - Examples
  - NASA Shuttle method

### **Module Eight**

- Understanding Failures & Failure Prevention Considerations
  - General considerations
  - Bolts too tight, or not tight enough
  - Self-loosening
  - Fatigue
  - Corrosion

### **Module Nine**

- Selecting Preload for an Existing Joint
  - How much preload depends on the application
  - Consideration of tools, scatter and failure consequence
  - Start at maximum approach
  - Start at minimum approach