

Boost your expertise  
with firsthand knowledge  
from industry experts

## Turbomachinery engineering seminar series

Sulzer is your global partner with reliable and sustainable solutions for your key operations. We offer repair and maintenance services for turbines, compressors, pumps, generators and motors. We also offer OEM and aftermarket parts. With one of the largest service networks in the industry, we are close to our customers with over 180 production facilities and service centers worldwide. Our cutting-edge engineering services provide unique and innovative solutions customized to your equipment needs.

Location: Sulzer Turbo Services Houston Inc. (La Porte, TX, USA)

Equipment: Primarily directed at rotating equipment (steam and gas turbines, hot gas expanders, centrifugal compressors) running on hydrodynamic fluid film bearings with proximity probe measurements and monitoring systems.

### Part 1 – Dynamic motion, transducers, measurements, monitoring, data processing, and alignment (4 days)

#### Section 1: Dynamic motion fundamentals

- Motion fundamentals and vector manipulation
- Undamped and damped mechanical vibration
- Forced lateral vibration
- Introduction to torsional vibration

#### Section 2: Transducer characteristics

- Dynamic signal attributes
- Proximity probe configuration, and application
- Velocity coils and accelerometers
- Vibration severity
- Specialized transducers and applications

#### Section 3: Dynamic signal evaluation

- Analog and digital filters
- Time and orbital domain
- Time and frequency domain
- Signal interaction and modulation

#### Section 4: Data acquisition, display and monitoring

- Monitoring system components
- Acquisition of machinery data
- Steady state and transient data formats
- Specialized data formats

#### Section 5: Machinery alignment

- Position measurement tools
- Shaft alignment offsets
- Dial indicator and laser alignment
- Alignment tracking and retention

## Part 2 – Machinery mechanical characteristics and modeling, common and unique malfunctions, and balancing (5 days)

### Section 6: Machinery mechanical characteristics

- Calculated and measured rotor mode shapes
- Inertia, stiffness and damping considerations
- Critical speed explanation
- Journal and thrust bearing characteristics,
- Shaft seals and coupling characteristics
- Influence of individual machine elements on overall train response

### Section 7: Machinery modeling

- Building a rotor, support and bearing model
- Common rda mechanical predictions
- Methods to validate rotor model accuracy
- Conversion from lateral to torsional model
- Identification of other rotor resonances
- Api 684 definitions and requirements

### Section 8: Common malfunctions

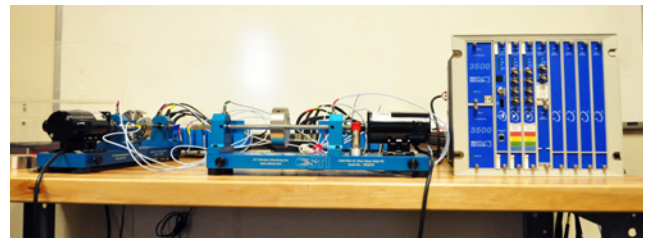
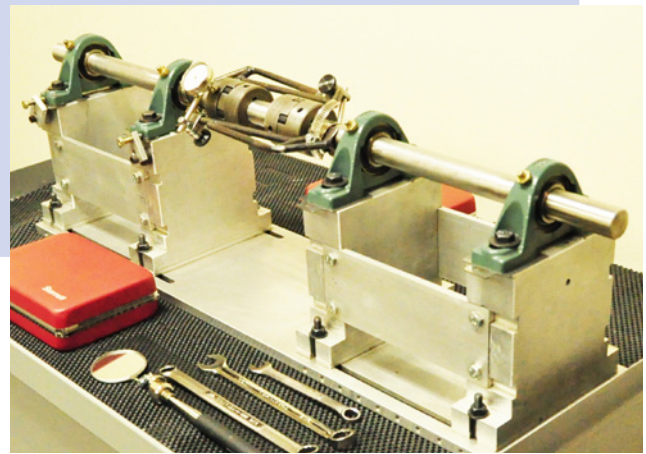
- Diagnosis of multiple 1x malfunctions
- Identification and correction of shaft preloads
- Identification and correction of resonance and stability problems
- Differentiation between looseness and rubs
- Identification and correction of foundation issues

### Section 9: Unique malfunctions

- Identification of shaft cracks
- Characteristics of gearboxes
- Fluid excitations, and calculations,
- Electrical excitations including electrostatic shaft voltage discharge

### Section 10: Effective rotor balancing

- Preparation and fundamental rules
- Balancing using mode shapes, orbits, and spreadsheets
- Balancing using bode and polar plots
- Low and high speed shop balancing
- Precautions and discipline required for field balancing at rated conditions



## Part 3 – Rotor modeling workshop (2 days)

Combination of presentations, plus demonstrations of proper setup and utilization of XLRotor. The instructor will be running the full version of XLRotor and sharing various displays on the main presentation screen. Attendees may download a demonstration version and follow along with the explanation of the various windows, data entry and overall model construction.

Sulzer provides cutting-edge services and solutions for rotating equipment dedicated to improving customers' processes and business performances. When pumps, turbines, compressors, generators and motors are essential to operations, customers need a service partner they can trust. With our technically advanced and innovative solutions, we give our customers the assurance they need to focus on their operations.



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### Engineering Services capabilities/service offering:

- Alignment tracking
- Machinery diagnosis
- Field balancing
- Performance rerates
- Technical upgrades (blade design improvements)
- Root cause failure analysis
- Rotordynamic analysis
- Turbomachinery engineering seminar series