

# Master Vibration Analyst Course - CAT IV

An ISO 18436 Category IV vibration analysis training course and certification provided in a format that makes complex concepts easy to understand.



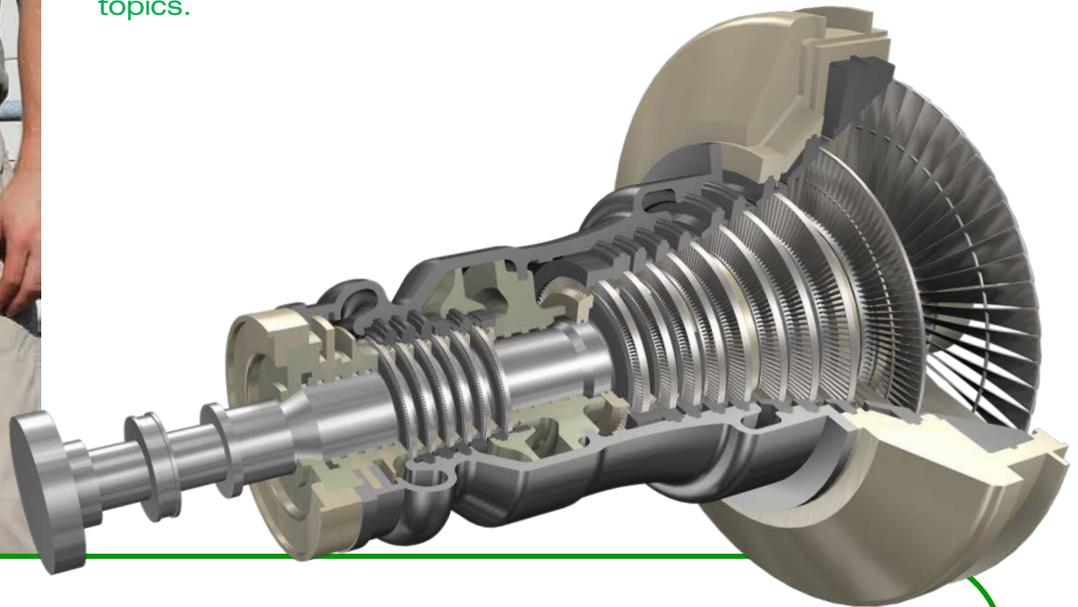
At the top of your game.

## You're almost there.

It's been a tough journey; you've paid your dues. You've been well trained, developed a wealth of experience, and built a good foundation of leadership. You are now ready to take the final steps to achieve the highest recognition in the field of vibration analysis. It's time to become a CATEGORY IV vibration analyst.

As a CATEGORY IV vibration analyst you are at the top of your game. You are qualified to lead condition monitoring teams and will have a deep understanding of machine dynamics and failure modes. With your knowledge and qualifications you are able to design tests to solve difficult problems and identify underlying issues to prevent reoccurrence. You will carry the highest regard in the field of machine condition monitoring. But be warned; everyone will be seeking your assessment of their machine problems!

Mobius Institute's MASTER Vibration Analyst course teaches you advanced measurement signal processing techniques, including torsional vibration and cross-channel measurements, dynamics including mass/stiffness/damping and natural frequencies, modal analysis and operating deflection shapes, orbit and centerline analysis, rotor dynamics, correction techniques including isolation, damping, and tuned absorbers, and other advanced topics.



### **Our CAT-IV hybrid course format saves you significant travel time and cost.**

Mobius Institute delivers its accredited MASTER course in a hybrid format that meets the ISO 18436-1 and ISO 18436-2 requirements while allowing you to complete Part One of the course through distance learning on your home or office PC. Part Two of our MASTER course is delivered in a live training venue where you complete the final week of the course and take the Category IV certification examination. Only Mobius Institute innovation offers the highest quality training while saving you weeks of travel time (and cost) in respect to competitive certification courses.

## Choose Mobius Institute

Excellent training is an art that is shared by few. Any training organization can develop a lesson plan and execute it. But the best trainers know how to invoke thought and imagination so that it resonates with a student's mind and develops better understanding of the subjects. Mobius Institute is a training organization that has spent a great deal of effort to develop its methodology and its skills in the art of training, thereby maximizing your ability to learn. Our training technology and methodology is so valuable and unique, we've branded it *Crystal Clear™* training.

Mobius Institute's Master Vibration Analyst course exceeds ISO 18436-2 CATEGORY IV requirements. Not only will you learn more; but you will do it with a greater understanding and less effort than from competitive offerings. Mobius Institute is an ISO/IEC 17024 accredited certification body, meaning your achievement and certification is honorable and recognized worldwide.

Learn from the best.

### Meet your instructor:



**Jason Tranter** - Founder & Managing Director, Mobius Institute

Jason Tranter has been involved with condition monitoring since 1984. He is the founder and managing director of the Mobius Institute and the Mobius Institute Board of Certification. Mobius Institute is ISO accredited to ISO 17024 and ISO 18436-1. Mobius has training centers in over 50 countries and has trained over 10,000 people in a classroom setting and many thousands more via e-learning. He is the author of the majority of Mobius' classroom material and the "iLearn" series of products, and is a member of ISO TC108/SC5. After running a vibration consulting and software development company in Australia in the mid-80's, Jason sold his business and moved to the United States for six years as the product development manager at DLI Engineering (now Azima/DLI). Over the years Jason has delivered presentations, workshops and had articles published all over the world.



## Course Details:

### Part One: WEB-based Learning

Duration: 4 days (equivalent)

#### Summary:

Part One of the course will be delivered via distance learning; access to a Web site will be required however a computer-based version will be available at an extra cost. The course will be taught by Jason Tranter, founder of Mobius Institute. Quizzes will be performed during the course in order to gauge comprehension.

The primary focus of this course is advanced signal processing, cross channel measurements, dynamics (mass/stiffness/damping, natural frequencies, modes), resonance testing (run-up/coast down tests, impact tests, ODS, modal analysis), and corrective action (flow control, resonance correction, isolation and damping). This course will take a practical approach to these subjects. Animations and software simulations will be used to make these topics easier to understand. Mathematics and theoretical derivations will be kept to an absolute minimum.

#### Certification:

See the Part Two course description for comments regarding the examination and the requirements for certification.

#### Detailed topic list:

##### Principles of vibration

- Vectors, modulation
- Phase
- Natural frequency, resonance, critical speeds
- Force, response, damping, stiffness

##### Data acquisition

- Test planning
- Test procedures

##### Reporting and documentation

- Vibration diagnostics reports

##### Signal processing

- RMS / peak detection
- Analog/digital conversion
- Analog sampling, digital sampling
- FFT computation
- Filters: low pass, high pass, band pass, tracking
- Anti-aliasing
- Bandwidth, resolution
- Noise reduction
- Averaging: linear, synchronous time, exponential
- Dynamic range
- Signal-to-noise ratio
- Spectral maps

##### Fault analysis

- Spectrum analysis, harmonics, sidebands
- Time waveform analysis
- Phase analysis
- Transient analysis
- Enveloping
- Electric motor defects
- Flow induced vibration, aerodynamics and liquids
- General fault recognition

##### Corrective action

- Flow control
- Isolation and damping
- Resonance control

##### Equipment testing and diagnostics

- Impact testing
- Forced response testing
- Transient analysis
- Transfer functions
- Damping evaluation
- Cross channel phase, coherence
- Operating deflection shapes
- Modal analysis

##### Reference standards

- ISO
- IEC
- Relevant national standards

##### Fault severity determination

- Spectrum analysis
- Time waveform analysis, orbit analysis
- Severity charts, graphs and formula



Mobius Institute's hybrid Master Vibration Analyst training program allows you to take the first part of the course from your home or office PC at your own pace. Part Two is given in a live classroom environment, allowing you to interact with your peers and expert trainers. At the end of the Part Two course you will be able to take your certification examination.

## Course Details:

### Part Two: Classroom based

Duration: 4 days

Examination: Provided on the 5<sup>th</sup> day (5 hour exam)

### Summary:

This four-day course will be delivered in a classroom environment. Quizzes will be performed during the course in order to gauge comprehension.

The primary focus of this course is the measurement, analysis, dynamics, and balancing of turbomachinery. Topics will include proximity probe and casing measurements, orbit and centerline plot analysis, rotor dynamics (natural frequencies, modeling), journal bearings (design, fluid film instabilities), and flexible rotor balancing. The course will also cover torsional vibration.

Note that this course is designed for people who have come up through the Category I, II, III development process; it is not necessary to have a degree in advanced mechanical engineering or dynamics – we will take a very practical approach. Utilizing advanced 3D animations and software simulations, topics that were possibly beyond the reach of many vibration analysts will be far easier to understand. The aim is to provide the level of knowledge that enables the vibration analyst to understand these topics to a high degree, with the expectation that if advanced analysis, design modification or modeling is required, a specialist in those areas will be called-in.

### Certification:

The Category IV examination will be offered on the fifth day. The exam consists of 60 questions which must be completed in five hours. In order to be certified the candidate must have completed parts one and two of this course, or provide evidence of equivalent training, and must provide verifiable evidence of 60 months experience.

## Detailed topic list:

### Principles of vibration

- Natural frequency, resonance, critical speeds
- Force, response, damping, stiffness
- Instabilities, non-linear systems
- Torsional vibration
- Instrumentation
- Prox probe operation, conventions, glitch removal
- Shaft and casing measurements

### Fault analysis

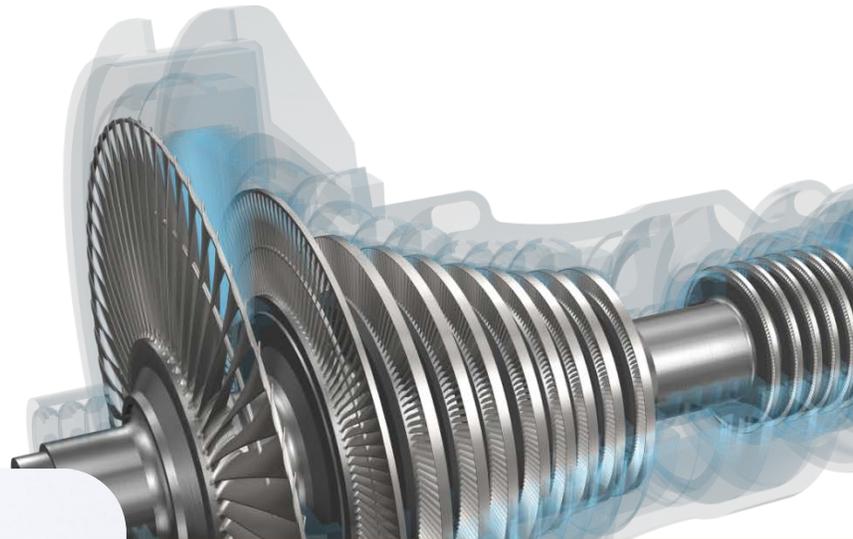
- Orbit analysis
- Shaft centerline analysis
- Transient analysis
- Unbalance, bent shaft, cracked shaft, eccentricity
- Rubs, instabilities
- Resonance and critical speeds
- Turbomachinery

### Corrective action

- Low and high speed shop balancing
- Field balancing (single plane, two plane, static/couple, flexible rotor)

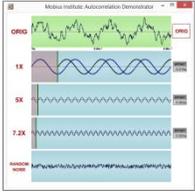
### Rotor/bearing dynamics

- Rotor/bearing dynamics
- Rotor characteristics
- Rotor modeling (rotor, wheels, bearings, aerodynamic effects)
- Bearing characteristics (fluid film bearings, housing and supports, seals, couplings)



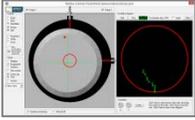
Mobius Institute Certified Vibration Analysts are authorized by MIBoC to use the CVA™ designation as part of their name and MIBoC certification logo as part of their printed and email signatures.

# Animations and simulations that make Cat IV understandable



Signal processing simulators demonstrating every aspect of the entire process from raw signal to finished data.

Simulations and animations that fully explain the ODS and modal analysis process.

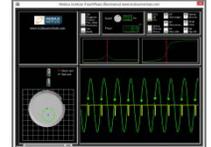
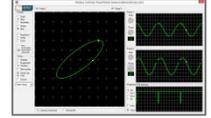
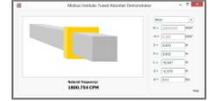
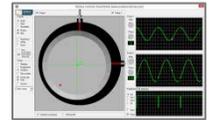
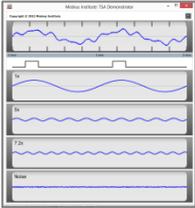


Numerous simulations demonstrating every aspect of the collection of prox probe data and the development of orbit and centerline plots.

3D animations of a turbine rotor (steam and gas turbine) demonstrating bending modes with different levels of stiffness provided by bearings.

Simulations explaining the basics of mass, stiffness and damping and their effect on the natural frequency (for SDOF and MDOF systems).

Simulations explaining (and calculating the parameters for) tuned absorbers and isolators.



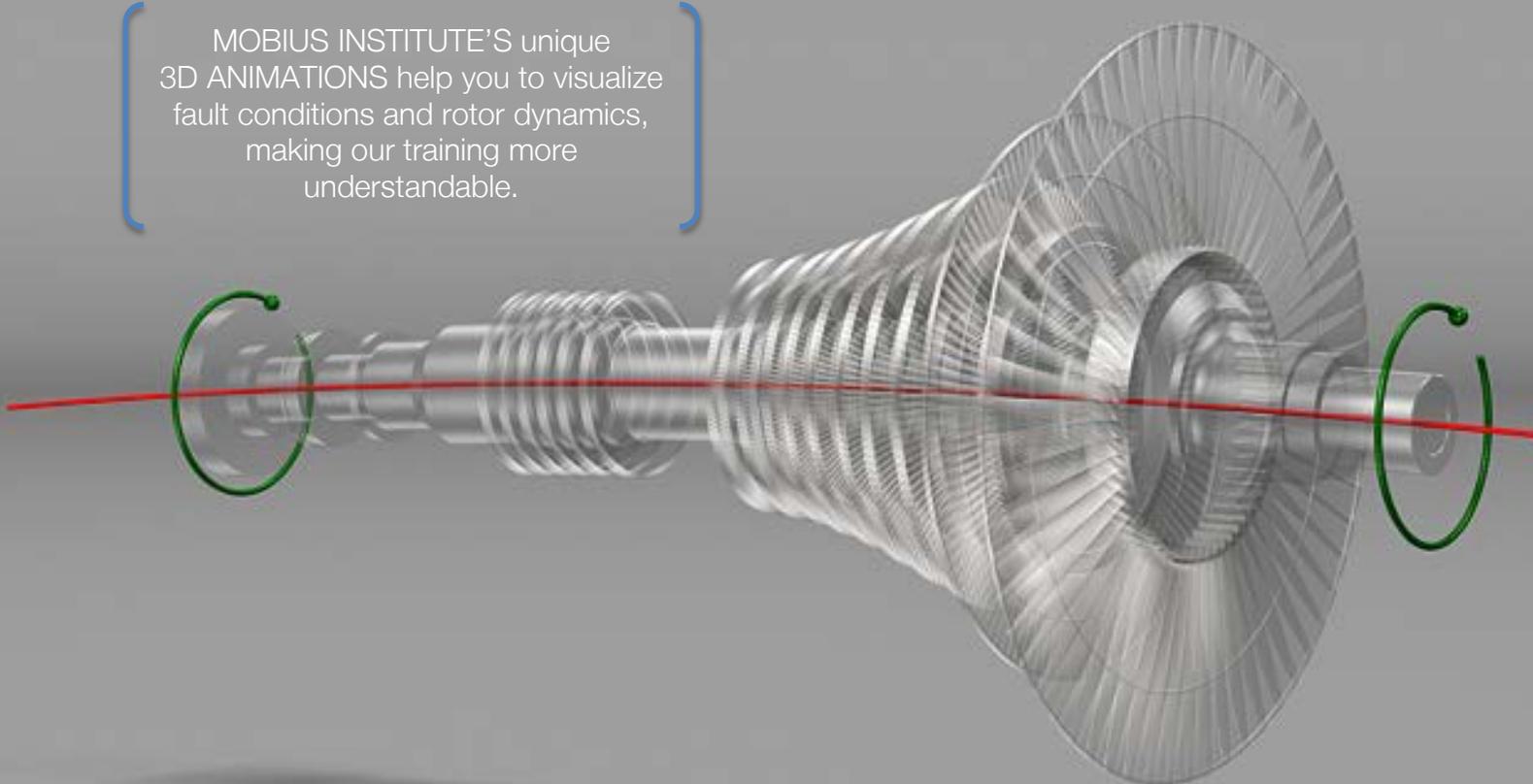
## Machinery Malfunction Diagnosis and Correction

*By Robert Eisenmann*

Robert Eisenmann's book examines the technology of analyzing process machinery malfunctions. It begins with fundamental concepts of mechanical motion, and expands the basic models into acceptable simulations of real machines. Relationships between the actual machinery, the analytical model, and the vibration characteristics are examined. Specifically, steam and gas turbines, gear boxes, centrifugal and reciprocating compressors, plus motors and generators are analyzed from different perspectives. It is extensively illustrated, and it contains detailed examples with sample calculations. The book also includes 45 case histories that cover the entire scenario from problem definition, through investigation, plus the final corrective solutions.

**ALL ATTENDEES of Mobius Institute's Master Vibration Analysis course will receive a complimentary copy of Robert Eisenmann's book (in PDF format).**

MOBIUS INSTITUTE'S unique 3D ANIMATIONS help you to visualize fault conditions and rotor dynamics, making our training more understandable.



## Why is it so important to choose Mobius Institute?

Mobius Institute analysts are more successful. A key element of Mobius Institute's great success is the application of our Crystal Clear™ training technology that allows complex concepts to be more easily understood. Proven and refined since 2005, Crystal Clear training provides students with a higher level of understanding of vibration analysis through its superior delivery, extensive use of hundreds of highly visual 3D animations, Adobe® Flash® technology simulations, and numerous software simulators to captivate the student's mind. Crystal Clear assures that students don't simply depend on memorizing vibration theory, but clearly understand it.



[www.MobiusInstitute.com](http://www.MobiusInstitute.com)

**Crystal Clear™**

Only from Mobius Institute

Mobius is the leading vibration analysis training organization. We've trained over 10,000 analysts from 128 countries since 2005. We have training centers in more than 50 countries. We are an accredited certification body per ISO/IEC 17024 and we certify analysts in accordance with ISO 18436-1 and ISO 18436-2. Mobius Institute is the only training provider that offers Crystal Clear training technology that makes complex topics easier to understand.

Call to find out more about VIBRATION INSTITUTE OF AUSTRALIA training courses

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THE BEST ANALYSTS ARE MOBIUS TRAINED™  
[www.MobiusInstitute.com](http://www.MobiusInstitute.com).