

Riser Analysis using OrcaFlex

COURSE CONTENT

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About Multisoft

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About Course

Riser Analysis using OrcaFlex Training by Multisoft Systems is a specialized program designed for professionals involved in offshore, subsea, marine, and oil & gas engineering projects. The training focuses on the practical application of OrcaFlex for modelling and analyzing offshore riser systems under different operating and environmental conditions. Participants gain exposure to riser configurations, structural and hydrodynamic properties, waves and currents, vessel motions, seabed interaction, and other parameters that influence riser behaviour.

The course provides practical understanding of static and dynamic riser analysis, including effective tension, bending moment, curvature, displacement, clearance, and touchdown zone response. Participants also explore fatigue and VIV considerations, extreme response assessment, sensitivity studies, and systematic interpretation of OrcaFlex simulation outputs. Through engineering-focused exercises and case-based analysis, the training helps learners establish a structured approach to offshore riser modelling, simulation, response evaluation, and technical reporting.

Module 1: Introduction to Offshore Risers and Riser Analysis

- ✓ Overview of offshore production systems
- ✓ Role of risers in offshore field architecture
- ✓ Riser functions and operating environments
- ✓ Fundamentals of riser analysis
- ✓ Static versus dynamic riser behaviour
- ✓ Key riser design and analysis considerations
- ✓ Introduction to numerical modelling of offshore risers

Module 2: Riser Types, Configurations, and Engineering Fundamentals

- ✓ Flexible and rigid risers
- ✓ Steel catenary risers (SCR)
- ✓ Lazy wave and steep wave configurations
- ✓ Free-hanging catenary configurations
- ✓ Top tensioned risers
- ✓ Hybrid riser concepts
- ✓ Riser geometry and configuration selection
- ✓ Touchdown zone and touchdown point concepts
- ✓ Effective tension and bending behaviour
- ✓ Interaction between riser configuration and environmental loading

Module 3: OrcaFlex Fundamentals for Riser Modelling

- ✓ OrcaFlex interface and modelling environment

- ✓ Understanding the OrcaFlex model hierarchy
- ✓ Model data and object configuration
- ✓ Units and coordinate systems
- ✓ Introduction to line objects
- ✓ Vessel and buoy objects
- ✓ Environment definition
- ✓ Model visualization and checking
- ✓ Static and dynamic calculation workflow
- ✓ Saving and managing simulation models
- ✓ Reviewing model warnings and calculation status

Module 4: Riser Geometry and Model Development

- ✓ Creating riser line models
- ✓ Defining riser end connections
- ✓ Specifying line length and segmentation
- ✓ Line sections and discretization
- ✓ Selecting appropriate segment lengths
- ✓ Initial riser configuration
- ✓ End constraints and boundary conditions
- ✓ Connection to vessel or floating structure
- ✓ Seabed and touchdown modelling
- ✓ Riser configuration checks
- ✓ Mesh sensitivity considerations
- ✓ Model refinement techniques

Module 5: Riser Properties, Materials, and Hydrodynamic Parameters

- ✓ Structural properties of risers
- ✓ Mass per unit length
- ✓ Outside and inside diameter
- ✓ Axial stiffness
- ✓ Bending stiffness
- ✓ Torsional stiffness considerations
- ✓ Riser contents and internal fluid properties
- ✓ Buoyancy effects
- ✓ Hydrodynamic diameter
- ✓ Drag coefficients
- ✓ Added mass coefficients
- ✓ Marine growth considerations
- ✓ Buoyancy modules and distributed buoyancy
- ✓ Property variation along the riser
- ✓ Understanding the influence of riser properties on response

Module 6: Environmental Conditions and Load Definition

- ✓ Offshore environmental loading concepts
- ✓ Water depth and seabed definition
- ✓ Current profiles
- ✓ Current direction and variation with depth
- ✓ Wave definition
- ✓ Regular and irregular waves

- ✓ Wave spectra concepts
- ✓ Wave direction and spreading considerations
- ✓ Wind loading considerations
- ✓ Hydrodynamic loading on risers
- ✓ Drag and inertia forces
- ✓ Combined wave and current conditions
- ✓ Environmental load combinations
- ✓ Selection of representative operating and extreme conditions

Module 7: Static Riser Analysis

- ✓ Purpose of static analysis
- ✓ Establishing static equilibrium
- ✓ Static solver considerations
- ✓ Riser catenary response
- ✓ Static effective tension
- ✓ Static curvature
- ✓ Bend moment response
- ✓ Riser position and geometry
- ✓ Touchdown point identification
- ✓ Touchdown zone behaviour
- ✓ Top tension assessment
- ✓ Clearance evaluation
- ✓ Static load-case comparison
- ✓ Diagnosing static convergence issues
- ✓ Interpreting static analysis results

Module 8: Dynamic Riser Analysis

- ✓ Fundamentals of time-domain dynamic analysis
- ✓ Dynamic simulation setup
- ✓ Simulation stages and duration
- ✓ Time-step considerations
- ✓ Vessel motion inputs
- ✓ Wave-induced riser response
- ✓ Dynamic tension variation
- ✓ Dynamic bending response
- ✓ Curvature response
- ✓ Riser displacement and motion
- ✓ Touchdown zone dynamics
- ✓ Transient response considerations
- ✓ Identifying peak response events
- ✓ Time-history results
- ✓ Statistical result evaluation
- ✓ Dynamic load-case comparison
- ✓ Simulation stability and convergence considerations

Module 9: Vessel, Floater, and Riser Interaction

- ✓ Modelling vessel connection
- ✓ Vessel position and orientation
- ✓ Vessel offset conditions
- ✓ Prescribed vessel motion
- ✓ RAO concepts and applications

- ✓ Translational and rotational vessel response
- ✓ Wave-frequency vessel motions
- ✓ Low-frequency motion considerations
- ✓ Riser response to vessel excursions
- ✓ Near and far offset cases
- ✓ Top connection response
- ✓ Influence of vessel motion on riser tension and curvature

Module 10: Riser Response, Stress, Curvature, and Design Checks

- ✓ Identifying critical riser response parameters
- ✓ Effective tension assessment
- ✓ Maximum and minimum tension
- ✓ Compression identification
- ✓ Bending moment evaluation
- ✓ Curvature assessment
- ✓ Bend radius considerations
- ✓ Top connection response
- ✓ Touchdown zone response
- ✓ Clearance assessment
- ✓ Contact with seabed
- ✓ Identifying critical locations along the riser
- ✓ Reviewing maximum and minimum values
- ✓ Range graphs and time histories
- ✓ Extracting engineering results from OrcaFlex

- ✓ Comparing results across load cases

Module 11: Fatigue, VIV, and Extreme Response Assessment

- ✓ Introduction to riser fatigue
- ✓ Sources of cyclic loading
- ✓ Wave-induced fatigue considerations
- ✓ Vessel-motion-induced fatigue
- ✓ Fatigue-sensitive riser locations
- ✓ Stress range concepts
- ✓ Fatigue load-case considerations
- ✓ Introduction to vortex-induced vibration (VIV)
- ✓ Current-driven VIV behaviour
- ✓ VIV-sensitive regions of a riser
- ✓ Understanding the relationship between VIV and fatigue
- ✓ Extreme environmental response
- ✓ Extreme tension and curvature assessment
- ✓ Identifying governing response conditions
- ✓ Limitations and assumptions in fatigue and VIV assessments

Module 12: Advanced Analysis, Sensitivity Studies, Results Interpretation, and Practical Case Study

Advanced Riser Analysis

- ✓ Complex riser configurations
- ✓ Buoyancy-supported riser systems

- ✓ Multiple line sections
- ✓ Nonlinear riser behaviour
- ✓ Seabed interaction considerations
- ✓ Contact and clearance scenarios
- ✓ Riser interference awareness

Sensitivity Studies

- ✓ Water-depth sensitivity
- ✓ Vessel-offset sensitivity
- ✓ Current-speed sensitivity
- ✓ Wave-condition sensitivity
- ✓ Riser-property sensitivity
- ✓ Drag coefficient sensitivity
- ✓ Buoyancy sensitivity
- ✓ Segmentation and discretization sensitivity
- ✓ Comparing sensitivity cases

Results Interpretation

- ✓ Reviewing simulation outputs systematically
- ✓ Time histories
- ✓ Range graphs
- ✓ Summary statistics
- ✓ Identifying maximum response
- ✓ Locating critical regions
- ✓ Comparing static and dynamic results
- ✓ Recognizing unrealistic model behaviour
- ✓ Engineering interpretation of OrcaFlex outputs

- ✓ Preparing analysis results for technical reporting

Practical Case Study

- ✓ Defining an offshore riser analysis problem
- ✓ Establishing model geometry
- ✓ Configuring riser properties
- ✓ Defining vessel and connection conditions
- ✓ Setting seabed and environmental data
- ✓ Running static analysis
- ✓ Checking equilibrium and model behaviour
- ✓ Configuring dynamic simulation
- ✓ Running representative environmental load cases
- ✓ Reviewing tension, curvature, displacement, and touchdown response
- ✓ Performing selected sensitivity cases
- ✓ Identifying critical response locations
- ✓ Comparing simulation cases
- ✓ Summarizing engineering observations
- ✓ Preparing a structured analysis report