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ANSYS

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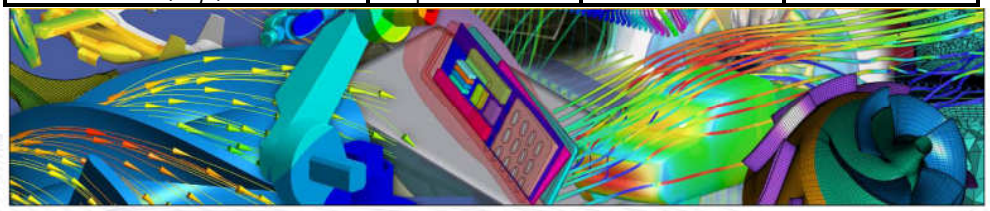
ROI Engineering Inc.

2009 ANSYS Courses Offered by ROI

Course Name & Duration (** = New)	Toronto	Montreal	Calgary
ANSYS Workbench Simulation Intro (3 Days) ANSYS Workbench Simulation Structural Nonlinear (Add 2 days)	February 2-6 June 22-26 August 31-Sep 4 December 7-11	February 23-27 August 10-14 October 5-9	April 6-10 May 18-22 June 29-July 3 August 31-Sep 4 October 12-16 November 23-27
** ANSYS Workbench Simulation Dynamics (2 Days)	May 4-5 December 3-4	September 8-9	
ANSYS Workbench DesignModeler (2 Days)	Jan 22-23 August 10-11	September 10-11	April 13-14 May 25-26 July 27-28 Sept 28-29 November 9-10
**ANSYS Workbench Simulation Heat Transfer (2 Days)	July 6-7 November 5-6	October 27-28	May 4-5 June 15-16 August 17-18 October 19-20
**ANSYS DesignXplorer (1 Day)	May 8 August 14	June 12	
**ANSYS Rigid and Flexible Dynamics (1 Day)	July 24 November 2	October 2	
**ANSYS Low Frequency Emag (3 Days) **Simulation Emag (Add 2 day)	August 17-21	June 8-12	
**ANSYS Intro to AUTODYN (3 Days)	February 11-13 June 10-12	May 27-29	
ANSYS AI*Environment (ICEM) 3 (Days)	April 1-3 September 23-25	December 7-9	



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ROI Engineering Inc.

2009 ANSYS Traditional Course Schedule

Course Name & Duration (** = New)	Toronto	Montreal
Introduction to ANSYS Part I (First 3 Days) Part II (Last 2 Days)	February 23-27 May 25-29 September 14-18 November 23-27	Mar 23-27 July 13-17 Nov 9-13
ANSYS Basic Structural Nonlinearities (2 Days) ANSYS Advanced Contact and Fasteners (Add 2 Days)	March 9-12 Oct 5-8	April 20-23
ANSYS Advanced Structural Nonlinearities (3 Days)	April 15-17 October 21-23	January 26-28 November 23-25
ANSYS Heat Transfer (2 Days)	June 8-9 October 15-16	January 29-30 August 17-18
ANSYS Dynamics (2 Days)	May 6-7 November 3-4	July 27-28
ANSYS LS-DYNA (3 Days)	January 19-21 July 8-10	May 25-27 November 25-27
ANSYS APDL (2 Days)	February 9-10 August 12-13	Oct 29-30
** ANSYS Intro to AUTODYN (3 Days)	February 11-13 June 10-12	May 27-29
** ANSYS Multiphysics Simulation for MEMS (3 Days)	April 27-29 December 14-16	August 19-21
ANSYS AI*Environment (ICEM)(3 Days)	April 1-3 September 23-25	December 7-9

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2009 ANSYS CFD Course Schedule

Course Name & Duration (** = New)	Toronto	Montreal
CFX Intro Part I (First 3 Days) ** CFX Part II (DesignModeler and Meshing Applications) (Last 2 Days)	Apr 6-10 July 13-17 November 16-20	January 12-16 March 9-13 October 19-23
** CFX Advanced Fluids, Multiphase, Turbulence (2+2+1 Days)	March 2-6 October 26-30	November 16-20
** Intro to CFD (3 Days) ** Fluid Structure Interaction (Add 1 Day)	March 16-19 August 4-7	May 5-8
**ANSYS FLUENT (4 Days)	February 17-20	Feb 10-13
**CFX Combustion & Radiation (2 Days)	September 21-22	July 22-23
**CFX Customization (1 Day)	October 9	April 24
**IcePak (3 Days)	May 11-13	September 21-23
**AirPak (2 Days)	May 14-15	Sep 24-25

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ANSYS Workbench Simulation Intro

3 Days

ANSYS Workbench-Simulation Introduction is an intuitive up-front simulation tool that is used in conjunction with CAD systems. It verifies product performance early in the concept and in the early design stages of product development.

The use of this tool enhances accelerated product development processes by providing rapid evaluations of multiple design scenarios and reducing the need for multiple designs and testing iterations. ANSYS Workbench - Simulation Introduction provides solutions for structural, thermal, modal, linear buckling, and shape optimization studies.

The training course provides students with the ability to operate ANSYS Workbench - Simulation and the basic understanding of simulation concepts and results interpretation.

Course Topics Include:

- Introduction
- Simulation Basics
- General Preprocessing
- Static Structural Analysis
- Free Vibration Analysis
- Thermal Analysis
- Linear Buckling Analysis
- Results Post-processing
- CAD & Parameters
- Asynchronous Solution (Appendix)
- Fatigue Module (Appendix)
- Shape Finder (Appendix)

Each course chapter is followed by "hands-on" workshops and exercises.

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ANSYS Workbench Simulation Structural Nonlinear

2 Days

ANSYS Workbench-Simulation Structural Nonlinearities is for engineers that need to perform structural nonlinear analyses using the Workbench-Simulation environment. It is intended for users already familiar with the procedures for performing a linear static analysis in Workbench-Simulation. The course introduces the nonlinear solution procedure and covers how to setup a structural nonlinear analysis, define nonlinear solution options, and review the nonlinear results. Advanced contact analysis procedures are discussed for simulating contact between two or more solid bodies. In addition, metal plasticity, hyperelasticity (including curve-fitting tools to help translate experimental data to strain energy density function coefficients), how to diagnose non-convergence problems, and how to interface with ANSYS are also covered in the training course.

Prerequisite: ANSYS Workbench-Simulation Introduction

Course Topics Include:

- Structural Nonlinearities
- Advanced Contact
- Metal Plasticity
- Hyperelasticity
- Nonlinear Diagnostics
- Accessing ANSYS Options

Each course chapter is followed by "hands-on" workshops and exercises.

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ANSYS Workbench Design Modeler

2 Days

The ANSYS Workbench - DesignModeler training course is for users that want to create and modify geometry in preparation for analysis in ANSYS or ANSYS Workbench.

Students who attend this course will learn how to:

- Create and modify geometry in preparation for analysis
- Navigate within the Graphical User Interface
- Generate 2D sketches and convert them into 2D or 3D models
- Modify 2D and 3D geometry
- Import existing CAD geometry
- Create line bodies and their cross sections in preparation for FE beam analysis
- Create surface bodies in preparation for FE shell analysis
- Model assemblies
- Utilize parameters

Each course chapter is followed by "hands-on" workshops and exercises.

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ANSYS Workbench Simulation Heat Transfer

2 Days

ANSYS Workbench-Simulation Heat Transfer is for engineers wishing to use Workbench Simulation to analyze the thermal response of structures and components. The course focuses on performing steady-state, transient, linear and nonlinear thermal analyses.

After completing the course, analysts should be able to analyze, in Workbench Simulation, the thermal responses of structures involving conduction, convection, and radiation.

Prerequisite: Basic Familiarity with Heat Transfer and ANSYS DesignModeler

The training course provides students with the ability to operate ANSYS Workbench-Simulation and the basic understanding of simulation concepts and results interpretation.

Course Topics Include:

- Fundamental Concepts of Heat Transfer
- Fundamental Concepts of Simulation
- Steady State Heat Transfer (no mass transport)
- Nonlinear and Transient Analysis
- Additional Convection/Heat Flux Loading Options and Simple Thermal/Flow Elements
- Radiation Heat Transfer
- Phase Change Analysis
- One Dimensional Flow Elements in Thermal Analysis

Each course chapter is followed by "hands-on" workshops and exercises.

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ANSYS Workbench Simulation Dynamics

2 Days

ANSYS Workbench-Simulation Dynamics is for engineers wishing to use Workbench Simulation to analyze the dynamic response of structures. The course focuses on performing modal, harmonic, flexible dynamic, and random vibration (PSD) analyses.

After completing the course, analysts should be able to analyze, in Workbench Simulation, the natural frequencies, mode shapes and mode participation factors of a linear elastic structure, the steady state response of a structure to sinusoidal loads of known frequency, the dynamic response of structures under the action of time-varying loads, and the random vibration of a structure using a power spectral density function (PSD).

Prerequisite: ANSYS Workbench Simulation Introduction

The training course provides students with the ability to operate ANSYS Workbench Simulation and the basic understanding of simulation concepts and results interpretation.

Course Topics Include:

- Introduction to Dynamics
- Modal Analysis
- Harmonic Analysis
- Flexible Dynamic Analysis
- Random Vibration (PSD) Analysis

Each course chapter is followed by "hands-on" workshops.

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ANSYS Workbench Rigid and Flexible Dynamics

1 Day

The ANSYS Rigid and Flexible Dynamic Analysis training course covers rigid and flexible body kinematics analysis using the Workbench-Simulation interface.

Students attending this 1-day training course will learn how to perform a Rigid body analysis that assumes rigid links between joints of a multi-bodied structure and calculates motion only at those joints. In addition, students will learn how to perform a Flexible body analysis that is similar to a Rigid body analysis except that it includes not just the joint motion but also considers the stiffness, mass, and damping effects of the flexible links.

The advantages of a Rigid Body analysis include:

- Rigid bodies are connected with joints resulting in a minimum number of DOF
- Very robust, no convergence issues
- Graphics provide complete visualization of the part motion
- Can be used interactively to test kinematics
- Can include springs and dampers

The advantages of a Flexible body analysis include:

- Bodies can be flexible
- All nonlinearities are supported
- All boundary conditions are supported
- Surface to surface contact between bodies can be included
- Rigid or flexible can be used on a part by part basis

Course Topics:

- Introduction to ANSYS Rigid and Flexible Dynamic Analysis
- Rigid Body Dynamic Setup
- Joints and Springs
- Rigid Body Dynamic Solution Setup and Joint Conditions
- Rigid Body Dynamic Postprocessing
- Flexible Dynamic Analysis

The training course also includes "hands-on" workshops for the students to complete.

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ANSYS Workbench Design Explorer

1 Day

ANSYS Workbench - DesignXplorer is an application that works with parameters to explore various design configurations and their analysis response. DesignXplorer offers dynamic interaction with the design envelope. Utilizing advanced parametric control, DesignXplorer provides instantaneous feedback on all your proposed design modifications, dramatically decreasing the number of design iterations and improving the overall design process. Its easy-to-understand GUI, based upon Workbench Technology, and accurate results finally allow concentration on more innovative designs. DesignXplorer incorporates both traditional and nontraditional optimization through a goal-driven optimization method. This allows users to consider multiple designs so they can create new items within their existing product lines or optimize parts for new conditions much more quickly and efficiently.

DesignXplorer interacts with ANSYS Workbench - Simulation and offers bi-directional associativity with leading CAD packages such as SolidWorks®, Solid Edge®, Mechanical Desktop®, Inventor®, Unigraphics® and Pro/ENGINEER®.

After completing the course, attendees should be able to use DesignXplorer to study, quantify, and graph various structural and thermal analysis responses on parts and assemblies.

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ANSYS Workbench Simulation Emag

2 Days

ANSYS Workbench-Simulation Emag is a 2-day training course that covers how to perform magnetostatic analyses of 3D geometric models using the SOLID117 edge formulated element available in ANSYS. The course covers the supported Electromagnetic features in the ANSYS Workbench - Simulation environment followed by six detailed workshop exercises.

Prerequisite: ANSYS Workbench-Simulation Intro

Course Topics Include:

- Feature Overview
- Underlying Technology
- Enclosures
- Boundary Conditions
- Modeling Permanent Magnets
- Modeling Conductors

Workshops:

- Creating Winding Bodies from Line Bodies
- Electromagnetic Analysis of a 2-Gap Solenoid
- Winding Editor
- Armature Gap Sweep
- Solid Conductor
- Low Frequency Electromagnetic Analysis of Motors

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ANSYS Workbench Low Frequency Emag

3 Days

A three-day course in Electromagnetic Analysis is recommended for analysts who perform magnetostatic, low frequency harmonic and transient electromagnetic analyses. Attendees learn how to set up and solve electromagnetic field problems, compute field quantities, extract forces, torque, eddy currents, and losses. Workshop problems include solenoid actuators, permanent magnet machines, and transformers. After completing the course, analysts should be able to perform two- and three-dimensional magnetostatic, harmonic and transient magnetic field analyses, circuit-coupled electromagnetic field analyses and calculate force torque inductance fields losses flux and saturation levels.

Course Topics include:

- 2D Planar and Axisymmetric Magnetostatic Analysis
- 2D Planar and Axisymmetric Harmonic Response (Steady State AC) Analysis
- 2D Planar and Axisymmetric Transient Analysis
- 3D Magnetostatic Analysis using the Scalar Potential
- 3D Harmonic Response and Transient Analyses
- Special Topics and Modeling Strategies

Each course chapter is followed by "hands-on" workshops and exercises.

Workshop problems include:

- Magnetic Clutch
- Current Excitation
- Skin Effects in a Solid Rectangular Bar
- Normally Closed Switch
- DC Electromagnet and Keeper
- Gear Induction Heating Using SOLID117
- Flux Passing Through Metal Detector Sense Coil Using SOLID97
- 2D Planar Rotating Machine Using Prepared Input Files
- Torque Calculations for 3D Periodic Devices
- Use LMATRIX to Determine Keeper Force
- Calculating Inductance and AC Resistance of Solid Conductors from Terminal Conditions

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ROI Engineering Inc.

ANSYS Workbench Introduction to CFX Part 1

3 Days

ANSYS CFX is a fluid analysis software tool that combines CAD input, automatic meshing and a fast solution algorithm. The ANSYS Introduction to CFX Part 1 Course is a three-day course and consists of lectures and "hands-on" practical examples. Basics of geometry creation, grid generation, physical model specification, solution, and post-processing are covered. Please note that only introductory material and related applications will be addressed.

Includes Introduction to DesignModeler and Meshing Application training.

Course Topics Include:

- DesignModeler Graphical User Interface (GUI)
- Workbench Window Manager
- Managing CAD Files
- Basic Geometry Creation
- CFX GUI and Workflow
- CFX-Pre Domains
- CFX-Pre Boundary Conditions
- CFX-Pre Solver Control
- CFX Expression Language
- CFX-Solver Manager
- CFX-Post
- Domain Interfaces
- Sources
- Additional Variables
- Initialization
- Transient Simulations
- Output Control

Each course chapter is followed by "hands-on" workshops and exercises.

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ROI Engineering Inc.

ANSYS Workbench Introduction to CFX Part 2

2 Days

ANSYS CFX is a fluid analysis software tool that combines CAD input, automatic meshing and a fast solution algorithm. The ANSYS Introduction to CFX Part 2 Course is a two-day course and consists of lectures and "hands-on" practical examples. This course builds upon the principles learned in Introduction to CFX Part 1, and educates students on the best practices for calculating a broad range of CFD problems.

Includes Introduction to DesignModeler and Meshing Application training.

Prerequisite: Introduction to CFX Part 1

Course Topics Include:

- Scripting and Automation
- Turbo Features
- Introduction to Radiation Modeling
- Profile Boundary Conditions
- Licensing Issues
- Project Mentoring*

Each course chapter is followed by "hands-on" workshops and exercises.

* Students are encouraged to bring a problem to the last day of the course to work on in conjunction with the CFX Instructor.

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ANSYS CFX Advanced Fluids, Multiphase, Turbulence

2 Days

This course is designed to expose ANSYS CFX users to advanced topics in CFD and fluid flow. The course covers the governing equations, boundary conditions, and numerical topics such as discretization and Convergence (pertinent to ANSYS CFX). Specialized topics in heat transfer, turbulence modeling, non-Newtonian effects, buoyancy, and compressible flows are covered.

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ROI Engineering Inc.

Intro to ANSYS Classic 1

3 Days

Recommended for anyone who performs finite element analysis (FEA) of mechanical parts or fluids and has little or no ANSYS experience, Introduction to ANSYS, Part I is a three-day course that focuses on basic linear, static analyses in any discipline. After completing the course, attendees should be able to maneuver efficiently within the ANSYS Graphical user interface (GUI), build two- and three-dimensional models, apply loads and obtain solutions as well as effectively verify the results of an analysis and display results.

Course Topics Include:

- FEA and ANSYS
- Getting Started
- ANSYS Basics
- General Analysis Procedure
- Creating the Solid Model
- Creating the Finite Element Model
- Defining Material Properties
- Loading
- Solution
- Structural Analysis
- Thermal Analysis
- Post-processing
- Short Topics
- ANSYS Native Geometry Creation (Appendix)

Each course chapter is followed by "hands-on" workshops and exercises.

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Intro to ANSYS Classic 2

2 Days

Designed for intermediate ANSYS users who perform FEA on mechanical parts or fluids, Introduction to ANSYS, Part 2 is a two-day course that teaches advanced modeling and analysis techniques - using array parameters, coupling and constraint equations, element coordinate systems and surface effect elements. In addition, beam modeling, sub-modeling, modal and bonded contact analyses are covered along with creating macro files. Upon completion, attendees should be able to apply the advanced modeling and analysis techniques supported by ANSYS.

Prerequisite: Introduction to ANSYS, Part 1

Course Topics Include:

- Array Parameters
- Coupling & Constraint Equations
- Working with Elements
- Beam Modeling
- Coupled Field Analysis
- Submodeling
- Modal Analysis
- Introduction to Nonlinear Analysis
- Bonded Contact
- Macro Basics

Each course chapter is followed by "hands-on" workshops and exercises.

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ROI Engineering Inc.

ANSYS Classic Basic Structural Nonlinearities

2 Days

Recommended for engineers who analyze structural nonlinear phenomena such as large deflection, plasticity or contact, this two-day course will aid in modeling geometric, material and contact nonlinearities, and in obtaining converged solutions with accurate results.

After completion, mechanical analysts should have a basic understanding of how to analyze structures with geometric nonlinearities, implement large strain theory in a nonlinear analysis and analyze structures with plasticity and contact nonlinearities.

Prerequisite: Introduction to ANSYS, Part I

Course Topics Include:

- Nonlinearities Overview
- Obtaining the Solution
- Postprocessing
- Basic Geometric Nonlinearities
- Basic Plasticity
- Introduction to Contact

Each course chapter is followed by "hands-on" workshops and exercises.

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ROI Engineering Inc.

ANSYS Classic Advanced Contact and Fasteners

2 Days

From contact stiffness and friction to surface-to-surface, node-to-node and bolt pre-tension elements, this two-day course is designed to analyze contact models that cannot be readily solved using default settings.

Prerequisite: Basic Structural Nonlinearities

Course Topics Include:

- Contact Overview
- Typical Applications & Contact Classifications
- Contact Stiffness
- Basic Concepts & Determining a Value
- Friction Contact and Auto Time stepping
- Surface-to-Surface Elements
- Advanced Options for Special Problems
- Rigid Surface Considerations
- Creating without the Contact Wizard & Troubleshooting
- Node-to-Node Elements
- Node-to-Surface Elements
- Bolt Pretension Elements
- PRETS179 Element and Typical Procedure

Each course chapter is followed by "hands-on" workshops and exercises.

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ROI Engineering—Toronto
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ROI Engineering Inc.

ANSYS Classic Advanced Structural Nonlinearities

3 Days

Focuses on element selection and the wide range of constitutive models available in ANSYS. Rate-independent plasticity, viscoplasticity/creep, and hyperelasticity are some of the topics which will be discussed. Geometric instability problems and element birth and death will also be covered.

Attendees will learn the appropriate element formulations to use, the input of nonlinear material parameters, and the applicability of the various constitutive models for engineering use.

Prerequisite: Basic Structural Nonlinearities

Course Topics Include:

- Introduction
- 18x Continuum Elements
- 18x Beam Elements
- 18x Shell Elements
- Advanced Rate-Independent Plasticity
- Creep
- Viscoplasticity
- Hyperelasticity
- Viscoelasticity
- Shape Memory Alloy
- Gaskets
- Geometric Instability: Buckling
- Element Birth and Death

Each course chapter is followed by "hands-on" workshops and exercises.

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ANSYS Classic Dynamics

2 Days

Engineers capable of analyzing the dynamic response of structures would benefit from this two-day course focusing on modal, harmonic and transient dynamic analysis. Upon completion, analysts should be able to:

- calculate natural frequencies and mode shapes of linear elastic structures (modal analysts)
- analyze the response of structures under the action of time-varying loads (transient analyses)
- analyze the response of structures with loads varying sinusoidally (harmonic response analyses)

Prerequisite: Introduction to ANSYS, Part I

Course Topics Include:

- Modal Analysis (definition & purpose, terminology & concepts, procedure)
- Harmonic Analysis
- Transient Dynamic Analysis
- Restarting an Analysis
- Spectrum Analysis
- Mode Superposition
- Modal Analysis - Advanced Topics (pre-stressed modal analysis, modal cyclic symmetry, large deflection modal analysis)

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ANSYS Classic Heat Transfer

2 Days

Engineers responsible for analyzing the thermal response of structures and components, are encouraged to take this course. The course focuses on performing steady-state, transient, linear and nonlinear thermal analyses.

After completing the seminar, analysts should be able to analyze:

- thermal responses of structures involving conduction, convection, and radiation
- the response of structures exhibiting special heat transfer phenomena including thermal-stress coupling and phase change.

Prerequisite: Introduction to ANSYS, Part I

Course topics include:

- Fundamental Concepts
- Steady State Heat Transfer (no mass transport)
- Additional Considerations for Nonlinear Analysis
- Transient Analysis
- Complex, Time & Spatially Varying Boundary Conditions
- Additional Convection / Heat Flux Loading Options and Simple Thermal / Flow Elements
- Radiation Heat Transfer
- Phase Change Analysis
- The Finite Element Approach to Thermal Analysis

Each course chapter is followed by "hands-on" workshops and exercises.

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ROI Engineering Inc.

ANSYS Classic Multiphysics Simulation for MEMS

3 Days

The course focuses on coupled physics simulation methods and techniques for common MEMS devices, such as:

- Thermal-electric actuators
- Comb drive resonators
- Micro-mirrors
- Switches and piezoelectric actuators.

Advanced technical concepts covered include:

- Electrostatics
- Capacitance extraction
- Piezoelectrics
- Pre-stress effects
- Initial stress effects
- Damping characterization via CFD simulation
- Thermal-electric coupled simulation
- Coupled electrostatic-structural dynamic simulation including time-harmonic and time-transients
- Sub-structuring
- Reduced order modeling using coupled transducer elements
- Pull-in and hystersis simulation and more.

Prerequisite: Introduction to ANSYS, Part I or Introduction to ANSYS for MEMS

Continued on next page.

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ANSYS Classic Multiphysics Simulation for MEMS

3 Days

Course Topics Include:

- Geometric Nonlinearities and Initial Stress Contact Analysis for MEMS Applications Pre-Stressed Modal Analysis Beam - Cross-Section Modeling
- Introduction to Electrostatic Analysis Capacitance
- Hybrid Trefftz-Finite Element Method for Open Domains
- Electrostatic-Structural Coupling Fundamentals Sequential Method for Electrostatic-Structural Coupling
- Direct Matrix-Coupled Electrostatic-Structural Methods using the TRANS126 Transducer
- Pre-Stressed Modal and Pre-Stressed Harmonic Analysis using TRANS126
- Large-Signal Transient Analysis using TRANS126
- Reduced Order Macro Modeling for System Simulation of MEMS Devices Introduction to Piezoelectric Analysis
- Introduction to Current Conduction Analysis Thermal-Electric Coupled-Field Analysis
- Thermal Stress Analysis
- Using CFD for Reduced Order Modeling Damping Characterization
- Units System for MEMS Simulation

Each course chapter is followed by "hands-on" workshops and exercises

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ROI Engineering Inc.

ANSYS Intro to AUTODYN

4 Days

This course is designed for new users who want to become proficient with AUTODYN. You will focus on learning core-modeling skills in this comprehensive, hands-on course. After completing the course you will be well prepared to work effectively on a wide range of transient dynamics applications.

Prerequisites

A basic knowledge of dynamics and strength of materials (material modeling) is highly recommended.

Knowledge of the physics of transient dynamics events is also recommended.

Format

This is a four-day course for AUTODYN held at our offices at regular intervals throughout the year. Due to the number of hands-on exercises and scope of materials covered, attendance is limited to 6 people. An optional workshop (see AUTODYN in Workbench) is offered on the fifth day after the course for attendees who wish work with the assistance of our technical staff to set up simulations of a specific problem of interest.

Course Outline:

- AUTODYN User Interface
- Lagrange Solvers
- Lagrange-Lagrange Joins and Interactions
- Euler Solvers
- ALE Solver
- SPH Solver
- Material Models
- Euler-Lagrange Interactions
- Remapping
- Parallel Processing
- User Subroutines

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ANSYS

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ROI Engineering Inc.

ANSYS AUTODYN in Workbench

1 Day

The AUTODYN Workshop course is made available for attendees of the AUTODYN Introductory Training course, who wish to work with the assistance of our technical staff to set up simulations of a specific problem of interest. It is offered on the day after the AUTODYN Introductory Training course is held.

Prerequisites

The AUTODYN Introductory Training course

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ROI Engineering Inc.

ANSYS LS-Dyna

2 Days

Beneficial to engineers who analyze problems involving contact, large deformations, nonlinear materials, high frequency response phenomena or problems requiring explicit solutions.

Attendees with prior modeling and nonlinear skills should be able to:

- distinguish problems that should be solved explicitly versus implicitly
- identify and choose element types, materials and commands used in explicit dynamic analyses
- perform all procedures for an explicit dynamic analyses

Course Topics include:

- Elements
- Part definitions
- Material definitions
- BDs, Loading, and Rigid bodies
- Solution and simulation controls
- Post-processing
- Restarting
- Explicit-to-Implicit sequential solutions
- Implicit-to-explicit sequential solutions
- ANSYS LS-DYNA drop test module

Each course chapter is followed by "hands-on" workshops and exercises.

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ROI Engineering Inc.

ANSYS AI*Environment (ICEM)

3 Days

The AI*Environment training course is for users that need to create finite element models using advanced meshing techniques and to review structural and other FEA solution results.

Course Topics Include:

- Navigating within the Graphical User Interface
- Creating geometry
- Importing CAD models
- Patch dependent/independent surface meshing
- Tetra solid meshing from original CAD and/or existing surface mesh
- Defining material properties
- Applying loads and boundary conditions
- Setting solution options and submitting jobs for FEA solvers
- Reviewing solution results
- Hexa-modeling for mapped solid mesh

Each course chapter is followed by "hands-on" workshops.

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ROI Engineering Inc.

Comprehensive ANSYS Intro

5 Days

The overall goal is to produce "rational and intelligent usage" by teaching the philosophy and fundamentals of ANSYS Traditional & WB. The systematic integration of the two interfaces will be addressed. FE concepts will also be discussed (averaging, stress convergence, etc.).

The course is intended to give knowledge of the ANSYS product for developing simulation models and performing structural analyses. The concepts can be easily extended to other analysis types. This course is a prerequisite for more advanced courses.

ANSYS Traditional Portion (2 Days):

- Processors (/PREP7, /SOLU, /POST1, /POST26) + overall philosophy
- Attributes: MAT, REAL, TYPE, SECN, ESYS
- Boundary Conditions
- Load Types (forces, pressures, acceleration, body temps etc.)
- Coordinate Systems (Global vs. Local)
- Discussion of elements
  - Types (0D, 1D, 2D, 3D) + new generation 18x series
  - Displacement functions (assumed response + limitations)
  - Integration point locations & interpolation/extrapolation
  - Integration schemes (reduced vs. full)
- Solution of Equations
  - [K][x]=[F]
  - Linear (i.e. small deflection) vs. Nonlinear analyses
- Post-Processing
  - Discuss results (poisson effect at constraints, comparison with closed form solutions – σ_x=My/I)
- Element averaging (nodal vs. element results) + singularities + stress convergence & mesh density
- Description of analysis types (Static, Modal, Harmonic, Random, Transient)
- APDL overview (review an input deck)

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Comprehensive ANSYS Intro

5 Days

ANSYS Workbench Portion (2 Days):

- WB GUI Overview + Philosophy (main differences with Traditional)
- CAD Integration + Parameters (DM)
  - Design Modeler
  - Supported body types
- Local Coordinate Systems
- Mesh Controls
  - Global Details
  - Methods
  - Sizing (scoped geometry)
  - Refinement
  - Virtual Topology
- Contact:
  - Pair Definitions (automatic generation + manual)
  - Types, behaviors, algorithms etc.
  - How they are interpreted by the ANSYS solver (target vs. contact)
- Worksheets (Sorting, Go-To functionality, Export to Excel, etc.)
- Boundary Conditions and Loading
- Solution
  - Environments
  - Options
- Results
  - Scoping
  - Reactions/Probes
  - Accuracy (stress convergence via adaptive refinement)
  - Animations, Export to Excel, Solution Combinations
- Multiple Environments/Models (Duplication)
- Report Generator

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Comprehensive ANSYS Intro

5 Days

Functional Integration of the Interfaces (1 Day):

- WB Geometry Based (fully) vs. Geom+FE control
- Information Accessibility
- WB CAD Integration
- WB Multiple Models/Environments for comparative studies
- Sequential Analyses & Initial Conditions
- WB Add-On Modules & Programs (DM, DX, Fatigue)
- Supported Capabilities in WB
- ETCONTROL (18x settings and defaults)
- WB Automatic Contact Generation + Options
- Output
- Interfacing Workbench with ANSYS Traditional
    - DM ANSYS Neutral File (ANF) CAD transfer
    - Input File + Named Selections/Components
    - Direct (traditional within WB Environment)
    - Command Snippets

The course will include similar tutorials in Workbench and Traditional in order to compare methodologies, strengths, and weaknesses of the two interfaces so that users will be able to choose the best method for future projects.

The final day is also intended to focus on comparing the two methods, and extend the functionality of Workbench through knowledge of ANSYS Traditional. This will provide the tools to combine the two methods and get the versatility of ANSYS Traditional with the productivity of the Workbench interface.

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Comprehensive ANSYS Structural

3 Days

The goal is to build upon the content of the introductory course and cover additional structural capabilities. This course is made up of excerpts from the Workbench Structural Non-Linear course, the ANSYS Basic Nonlinearities course, and the ANSYS Advanced Contacts and Fasteners course. Each of these courses is originally 2 days. By eliminating overlap and cutting unwanted details (ie. hyperelasticity), the total length is reduced to 3 days. (It should be noted that the section "Accessing ANSYS Options" has been removed because it is covered in the introductory course.)

Prerequisite: Comprehensive ANSYS Intro Course

A general outline of the topics to be covered follows:

- Nonlinearities (cause, how they're solved...)
- Basic Contact (basic concepts, setting up contact pairs, formulations)
- Advanced Contact (non-linear contact settings, troubleshooting)
- Material Models (basic plasticity models)
- Solution Settings
- Post-Processing
- Nonlinear Diagnostics

Each course chapter is followed by "hands-on" workshops.

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Comprehensive ANSYS Thermal

3 Days

Building on the knowledge gained from the comprehensive introductory course, the fundamentals and advanced concepts of thermal analysis will be covered. This course is made up of excerpts from the ANSYS Workbench - Simulation Heat Transfer course and the ANSYS Traditional Heat Transfer course. Each of these courses is originally 2 days. By eliminating overlap and cutting unwanted details (i.e. phase change), the total length is reduced to 3 days.

Prerequisite: Comprehensive ANSYS Intro Course

A general outline of the topics to be covered follows:

- Fundamental Concepts of Heat Transfer
- Steady State Heat Transfer (no mass transport)
- Nonlinear Analysis
- Transient Analysis
- Complex, Time & Spatially Varying Boundary Conditions
- Additional Convection/Heat Flux Loading Options
- One Dimensional Flow Elements in Thermal Analysis
- Radiation Heat Transfer

Each course chapter is followed by "hands-on" workshops.

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