

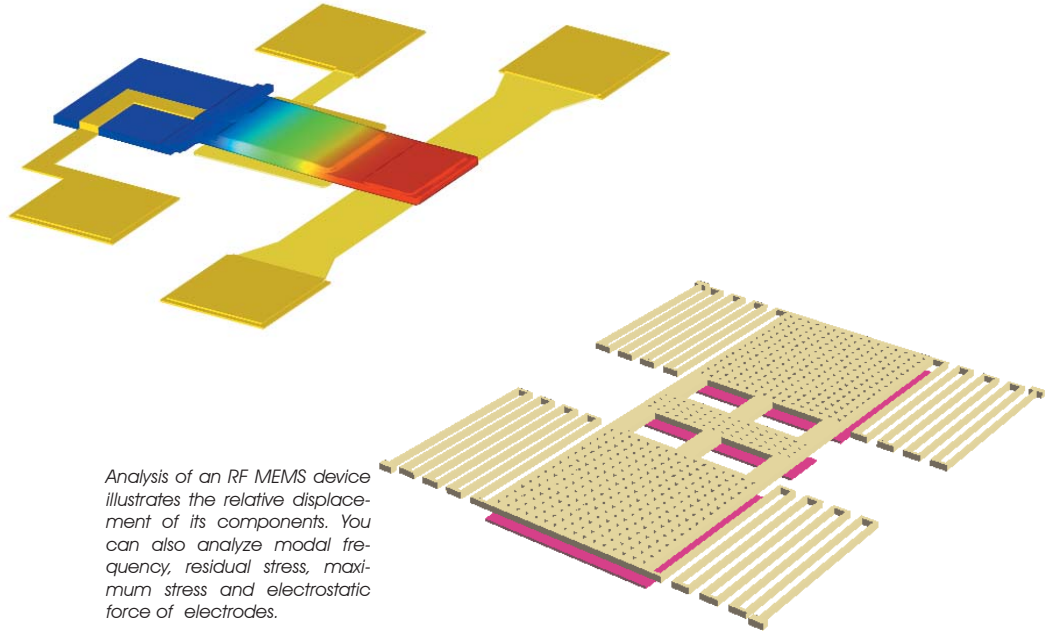
# ANALYZER

from Coventor, Inc.

- Industry-leading suite of MEMS-specific field solvers for electrostatic, structural, thermal, piezoelectric, piezoresistive, damping, electromagnetic, optical, and microfluidic analyses
- Offers best-in-class coupled physics solver for electromechanical analysis
- Includes powerful pre- and post-processing with automatic mesh generation, result queries and 3-D result visualization
- Provides unified access to all solvers in an easy-to-use graphical user interface that reduces training time and automates model and result management and tracking

## ANALYSIS TOOLS FOR MEMS DEVELOPMENT

ANALYZER is Coventor's extensive suite of 3D field solvers designed specifically for MEMS applications. ANALYZER gives you the ability to analyze and simulate the behavior of MEMS devices that are subject to multiple physical effects.



*Analysis of an RF MEMS device illustrates the relative displacement of its components. You can also analyze modal frequency, residual stress, maximum stress and electrostatic force of electrodes.*

### ANALYZER at a Glance

**MEMS Solvers:** Perform complex, fully coupled, multi-domain physics analysis with our comprehensive suite of MEMS-specific solvers. Reveal the interaction between domains using true-coupled electrostatic, mechanical, PZE, and thermal analyses. Offer package-device interaction analysis. Expose time-dependent behaviors of MEMS devices with transient mechanical and thermal analyses. And, perform optical analysis to evaluate beam diffraction in optical MEMS devices.

#### Query, View, and Compare

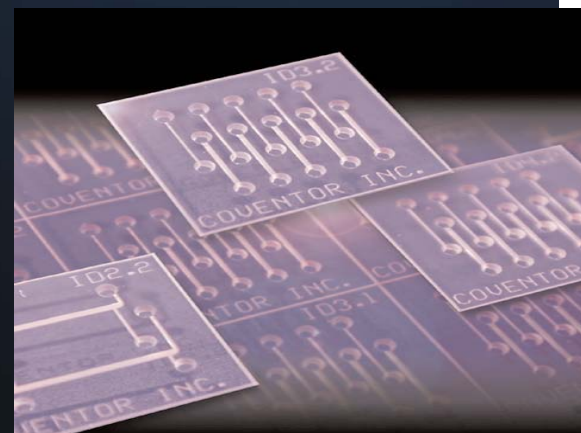
**Results:** Quickly examine results of analyses in selectable presentation formats. The powerful query capability enables you to easily extract a wide variety of results over a wide range of parametric conditions.

#### Automatic Meshing:

Mesh MEMS structures with precision using our automated mesh generator. Mesh volumes using hexahedral or tetrahedral elements. Mesh surfaces using triangular and quad elements. Mesh structures with sloped sidewalls with the mapped brick mesher. Various mesh control techniques, such as boundary refinement and bias, are available.

#### Microfluidic Solvers:

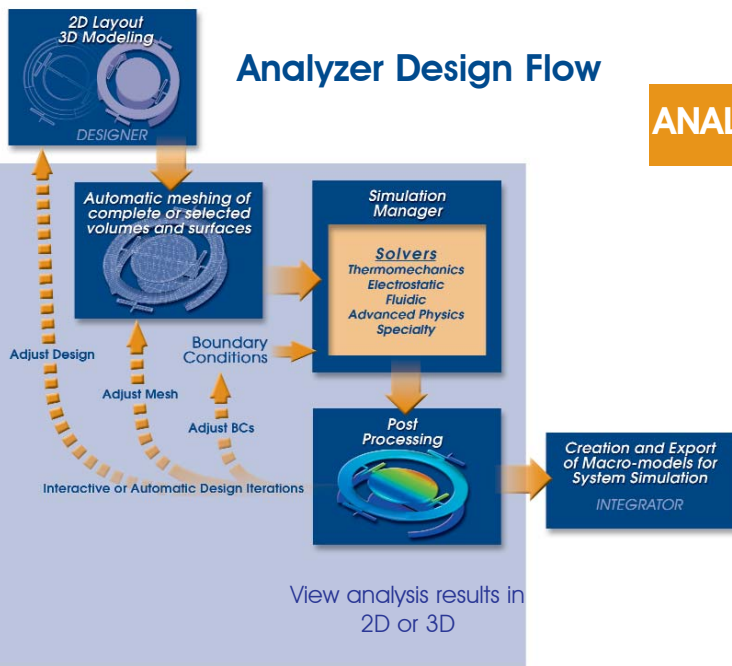
Examine chemical transport and containment physics of lab-on-chip applications in DNA, protein, and chemical analyses. Analyze full 3D electro-phoreses, electro-osmosis, and mixed electro-kinetics. Perform a multi-phase analysis to predict drop or bubble behavior for inkjet or dispensing applications.



COVENTOR™

WHAT'S NEXT. AND NEXT. AND NEXT.™

## Analyzer Design Flow



## ANALYZER - Comprehensive MEMS Physics

- Structural Mechanics**
  - linear and non linear
  - contact
  - static and transient
  - modal and harmonic
  - thermomechanical
  - piezoelectric
  - piezoresistive
  - electro-thermal-mechanics
- Electrical/Electrostatics**
  - capacitance
  - charges
  - dielectrics
  - electroquasistatic
- Coupled Field**
  - combinations of electrostatic/structural/thermal/piezo electric/piezoresistive and fluidic
- Electromagnetics**
  - resistance and inductance
  - full wave EM solver
- Parametric Study**
  - automatic parameter variation of: boundary, material, and dimensions
- Damping**
  - squeeze film, lateral and shear
  - reduced order modeling
  - free space, large angles
- Microfluidics**
  - compressible and incompressible
  - laminar analysis
  - buoancy driven flow
  - newtonian and non-newtonian
  - viscosity models
  - fluid structure interaction
  - steady-state or transient
  - reaction chemistry and enzyme kinetics
  - electrohydrodynamics
  - non-inertial reference frame
  - multi-phase flow
  - electrokinetics flow
  - nucleation and phase transition
  - fluid interaction with rigid bodies
  - multi CPU support for multi phase flow

## ANALYZER SOLVERS

MEMS	STANDARD	<b>MemElectro</b> Analyzes boundary element model electrostatics, for electrostatic force and capacitance calculations of 3-dimensional structures comprised of conductors and dielectrics  <b>MemMech</b> A full Finite Element Analysis tool for structural, thermal, electro-thermal and piezoelectrical physics. Performs modal, harmonic, contact, steady-state and transient computations.  <b>Co-Solve EM</b> Analyzes coupled electromechanics with hysteresis	
	TURBO	<b>ANALYZER Standard, plus:</b>  <b>Enhanced MemElectro Co-Solve &amp; MemMech</b> Advanced capability for analysis of boundary element model electrostatics to enable faster runs, using less memory, with special symmetry options	
ADD ON	<b>MemPZR</b> Computes resistance field, equilibrium potential, and current density fields of resistors under mechanical stress  <b>MemPZE</b> Piezo electric analysis capabilities that couple with mechanical analysis  <b>MemHenry</b> Solves for frequency dependent resistance and inductance  <b>MemOptics</b> Analyzes optical beam propagation and diffraction  <b>MemPackage</b> Analyzes package-induced effects on MEMS devices  <b>INTEGRATOR</b> Add the INTEGRATOR module in order to connect your field solver results to your ASIC design environment in SABER-MAST, CADENCE-Verilog-A or MATLAB-Simulink  <b>DampingMM</b> As part of INTEGRATOR the DampingMM module calculates all types of damping and can be added as a separate module in ANALYZER		
	MICROFLUIDICS	<b>NetFlow</b> Analyzes fluid flow and chemical transport in electro-kinetic, and mixed electro-kinetic systems  <b>MemCFD</b> Solves for general purpose CFD  <b>SwitchSim</b> Computes electro-kinetic response of a species in a fluid subjected to a switched electric field  <b>ReactSim</b> Performs 3D numerical modeling of multiple reacting chemical species, coupled with fluid flow, heat transfer, diffusion, and electro-kinetics  <b>Bubble-DropSim</b> Provides full 3D numerical simulation of the movement of bubbles and surrounding fluids in micro-channels, of droplet formation, transport, and impact. Includes Electro-Hydro-Dynamic capabilities in multi-phase flow  <b>MemFSI</b> Provides detailed 3D analysis of fluid-structure interaction <td> <b>INKJET, DISPENSER and BIO CHIP DEVELOPER</b> </td>	<b>INKJET, DISPENSER and BIO CHIP DEVELOPER</b>

## Coventor products

**CoventorWare** is ideal for developing MEMS and microsystems for an unlimited variety of applications including optical communications, RF/wireless communications, biotechnology, automotive, and sensors

- ARCHITECT:** Multi-domain technology simulator for device, component or system level products including physical models, control models and Electronics
- DESIGNER:** MEMS device construction tool; generates 2-D mask layouts and 3-D solid models; includes material property database, process editor and import/export capabilities
- ANALYZER:** Group of field solvers for detailed physical analysis requiring thermoelectromechanics, optics, fluidics, electromagnetics, and more
- INTEGRATOR:** Tools to extract detailed design-specific behavioral models from Finite Element straight into Saber, Cadence or Matlab-Simulink
- MEMulator™:** A versatile virtual prototyping tool used to emulate complex MEMS processes
- Etch3D™:** A 3D simulator for anisotropically etching Silicon in any orientation with etchants such as KOH, TMAH, and others



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

**World Headquarters & Eastern U.S. Sales**  
 4000 CentreGreen Way  
 Suite 190  
 Cary, NC 27513  
 Tel 919.854.7500  
 Fax 919.854.7501

**Western U.S. Sales**  
 951 Mariner's Blvd.  
 Suite 205  
 San Mateo, CA 94404  
 Tel 650.212.6367  
 Fax 650.212.6362

**European Sales**  
 3, avenue du Quebec  
 91951 Courtaboeuf Cedex  
 France  
 Tel +33 (0)1 69 29 84 94  
 Fax +33 (0)1 69 29 84 88

**Worldwide Distribution**  
 Japan: [www.msol.co.jp](http://www.msol.co.jp)  
 Taiwan: [www.apic.com.tw](http://www.apic.com.tw)  
 China: [www.imag.com.cn](http://www.imag.com.cn)  
 Korea: [www.davan.co.kr](http://www.davan.co.kr)  
 Singapore: [www.ftdsolutions.com](http://www.ftdsolutions.com)  
 India: [www.ftdpl.com](http://www.ftdpl.com)