

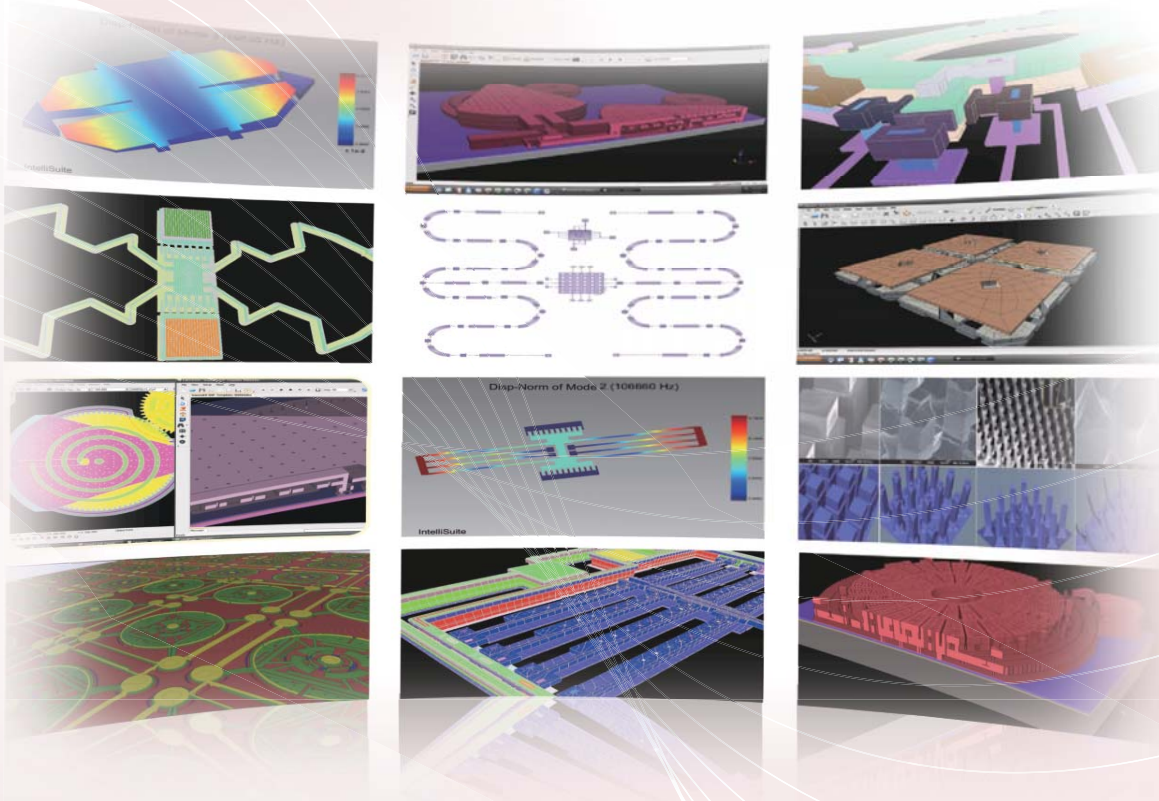
# IntelliSuite

## The shortest distance between your MEMS concept & product

IntelliSuite contains a wide range of closely integrated tools to seamlessly go from schematic capture and optimization to design verification and tapeout. A flexible design flow allows you to start your design at either schematic, layout or 3D level. Blueprint is a physical design tool that incorporates advanced layout, design rule check, cross section exploration, and automated mask to hex mesh capabilities. CleanRoom process suite allows you to create and debug your process flow and your mask set before you enter the clean room. It allows you to make virtual prototypes to save costly fabrication mistakes. Advanced Fastfield Multiphysics tools feature fully coupled electrostatic, mechanical, fluidic, and electromagnetic engines. Advanced Model Order Reduction based Extraction techniques capture electromechanical, fluidic and damping behavior into compact models, while EDA Linker seamlessly links IntelliSuite to other leading EDA tools.

The IntelliSuite software architecture is based upon a unique combination of bottom-up process-driven design and top-down synthesis. Top-down methodology allows you to quickly explore a wide range of design options, while bottom-up design provides the accuracy to produce first-time right silicon.

The accurate bottom up process-driven design and top down schematic-driven synthesis are combined to get you to your designs faster and with less process iterations.



## CleanRoom



IntelliSuite's bottom-up architecture is based upon process elements - familiar process steps, such as photolithography, thin film deposition, selective etching form the basis of understanding the final device geometries. By systematically building the prototype in IntelliSuite, you can identify costly process bugs before entering the fab, which ultimately saves time and money. The process steps, combined with the mask geometries, can be used to build the final virtual device.

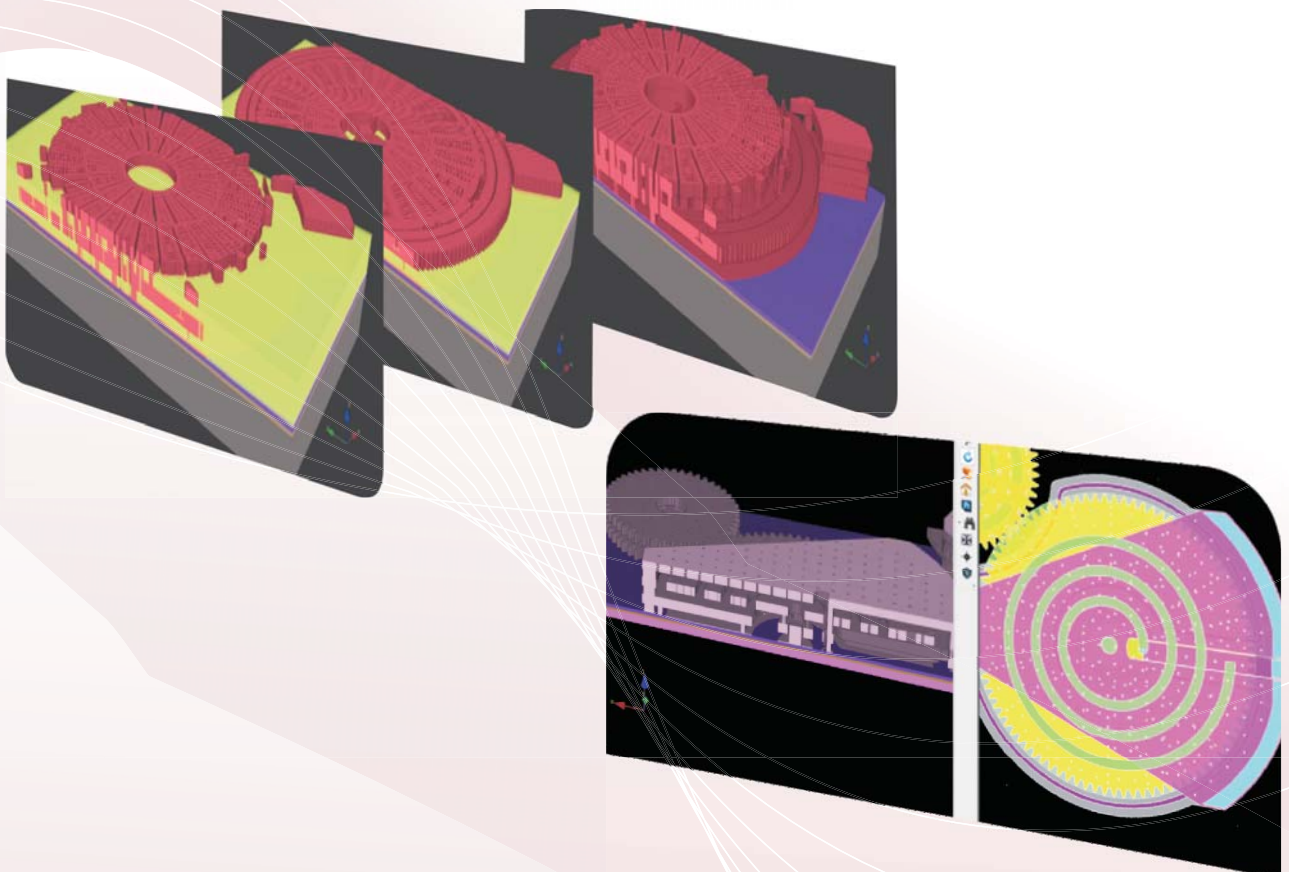
IntelliSuite features a comprehensive material database which allows you to understand material properties like conductivity, film stresses and mechanical strength as a function of processing parameters. Subsequently, this enables you to produce more realistic models.

Etching has always been a bugbear in MEMS technology. IntelliSuite includes wet and dry etch simulators - a full anisotropic wet etch simulator for creating realistic models of your KOH, TMAH or EDP etches, and a dry etch simulator for simulating RIE/ICP and Bosch etch processes.

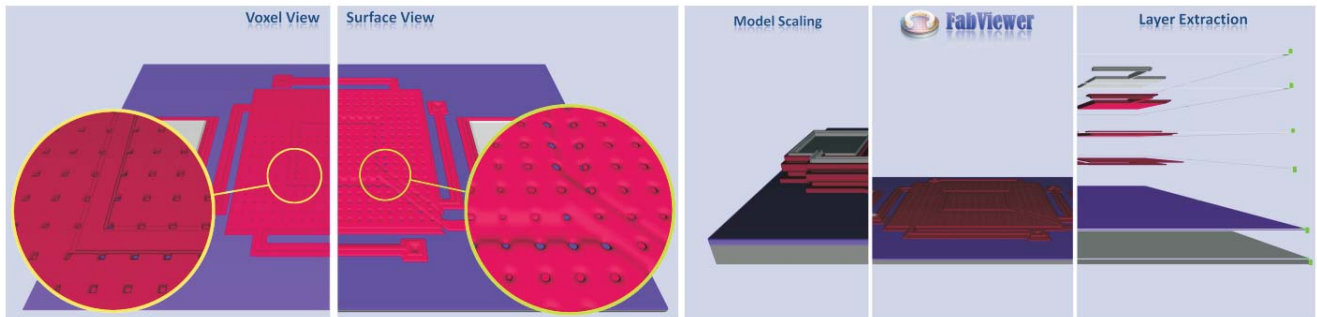
Process flows can be exported to Microsoft PowerPoint in cross-section or full 3D mode.

On our website, you will find some actual PPT/PDF output examples from CleanRoom.

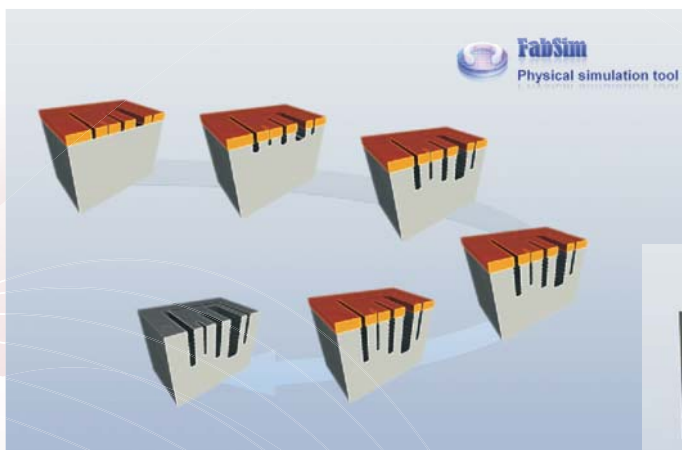
**IntelliFAB** allows you to debug your process flow and your mask set before you even enter the clean room. It enables you to create realistic virtual prototypes, which can prevent costly fabrication mistakes.



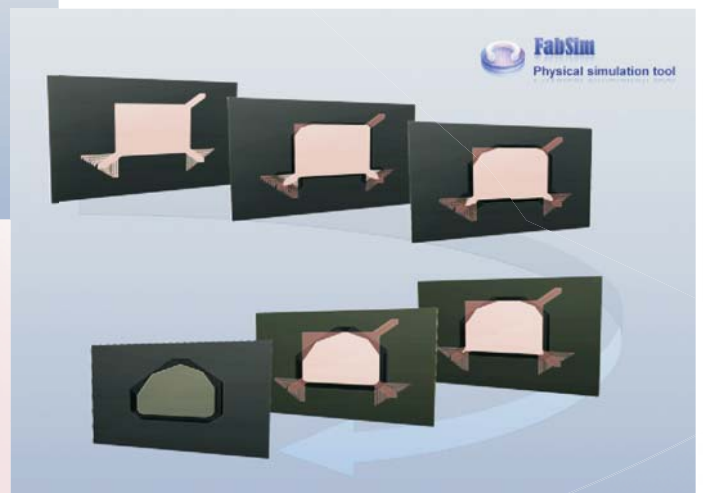
**FabViewer** is a voxel based 3D viewing tool for your process flow. Visit [www.intellisense.com](http://www.intellisense.com) to download a free copy that includes some popular process design kits.



**FabSim™** enables users to quickly create photo-realistic process models and cross-sections using full physical simulation, rather than traditional geometrical methods.



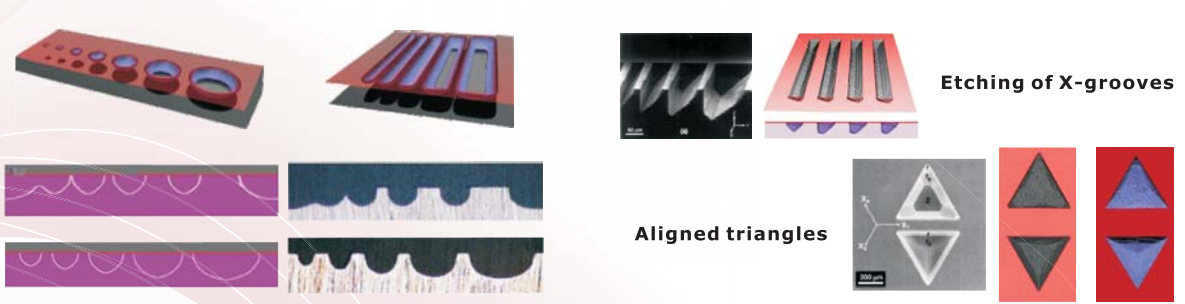
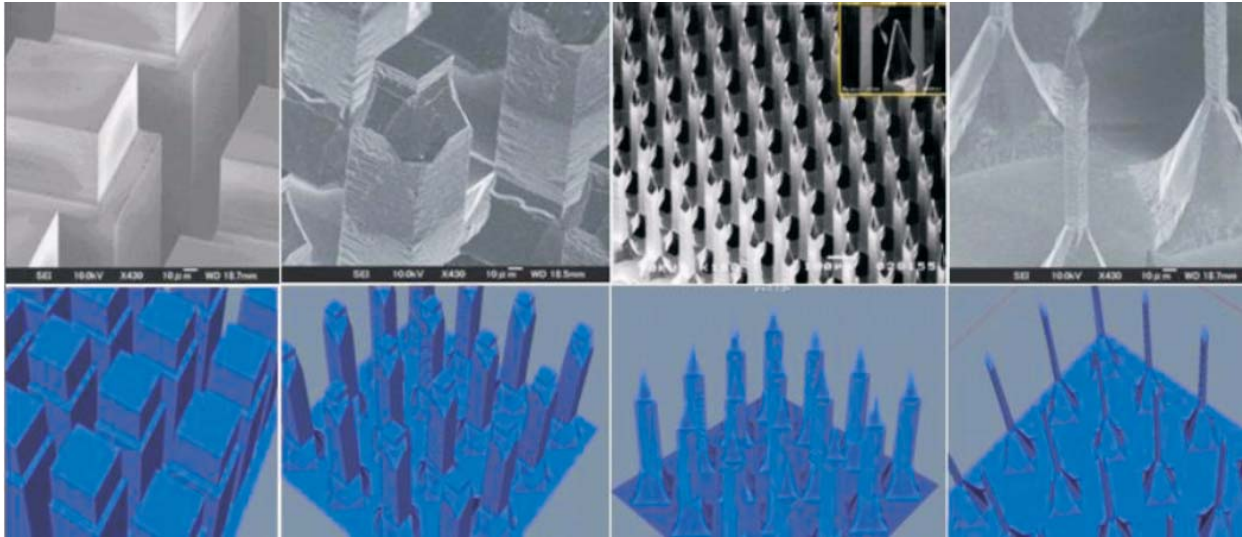
Physical process simulation of RIE, DRIE, Wet Etching



IntelliSense has long been the MEMS industry's leader in physical process simulation, with tools like **RECIPE** for DRIE etch simulation, **IntelliEtch** for wet etch simulation, and **Exposure** for lithography simulation. All of this functionality is now integrated into IntelliSuite's flagship process simulator, **FabSim**.

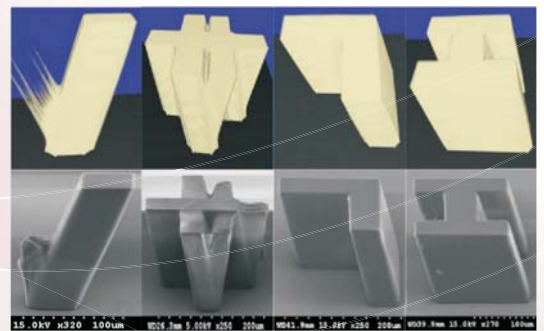
## IntelliEtch™

The industry's most powerful wet etch simulator can now simulate anisotropic etching of quartz in addition to silicon. Features that IntelliEtch is known for, like etching of highorder planes and multi-masking, are made easier to use in a huge interface update. The new GPU-based simulator can run etch simulations over 100 times faster than the previous CPU-based version.

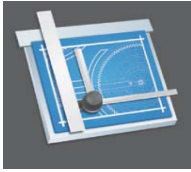


IntelliEtch for Sprayetching of copper and Quartz etching

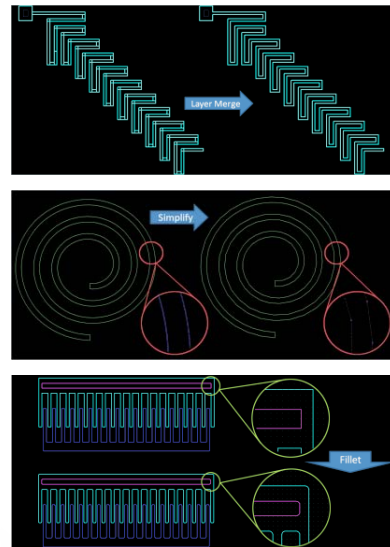
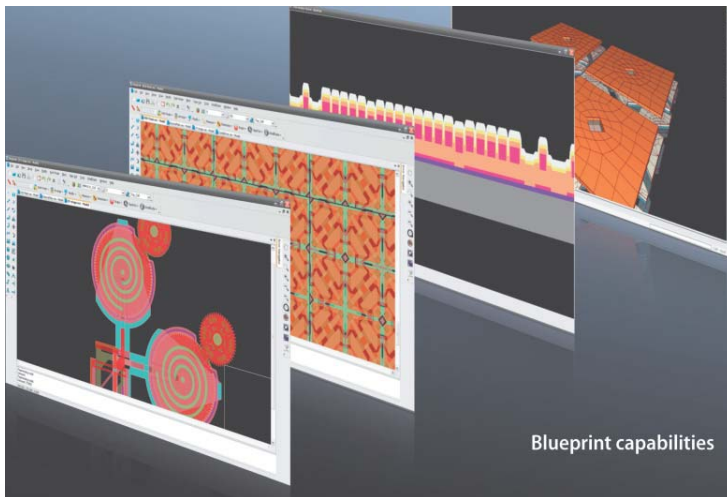
**Exposure™** is a new addition to IntelliSense's strong suite of process simulation tools. This deep resist/SU8 simulator can accurately model lithography processes like exposure, post-exposure bake, and development. The dynamic cellular automata simulator and included material databases ensure robust and speedy lithography simulations.



**Blueprint** is a layout tool specifically designed for the MEMS community.

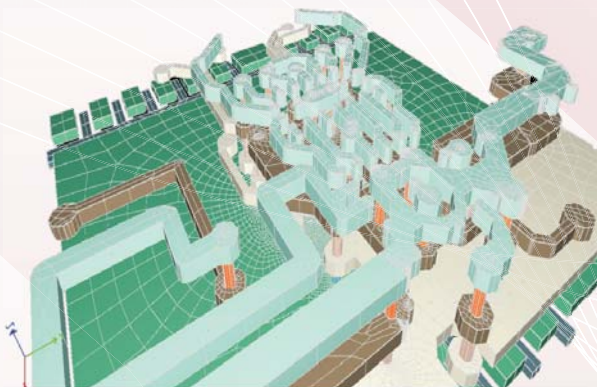


Blueprint includes TapeOut, an all-angle Physical Verification (DRC) tool, and a language-independent scripting tool, enabling you to create complex designs through scripting. The built-in Cross-Section Viewer allows you to view mask cross-sections and export them to PowerPoint. Automated hexahedral meshing techniques can be used to construct robust meshes for analysis.

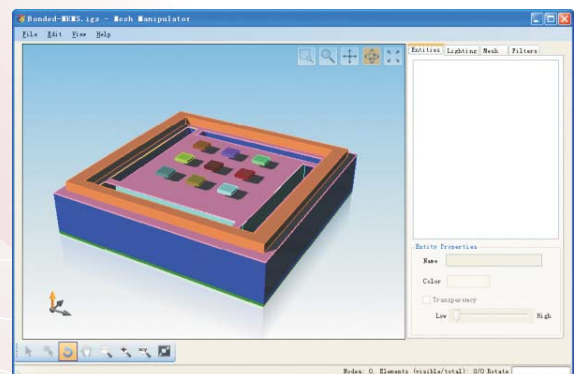


### **3DBuilder™ / Hexpresso™**

IntelliSuite's state-of-the-art automeshing tools are again updated with cutting-edge advancements. Material properties and boundary conditions can be automatically applied when a 3D meshed model is generated. New adaptive meshing and mesh refinement settings allow users to have full control over the automated meshing process. Meshing is now faster and more robust than ever before.

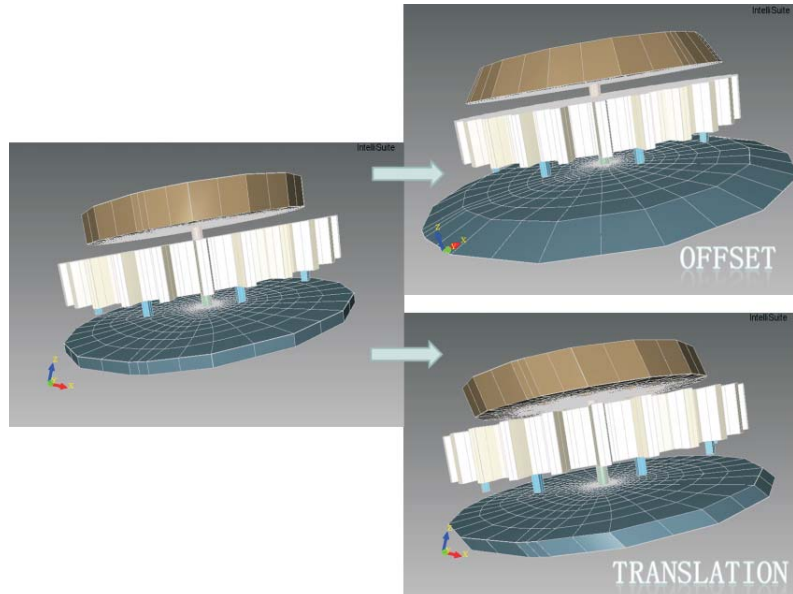


**Auto mesh to packaged structure**

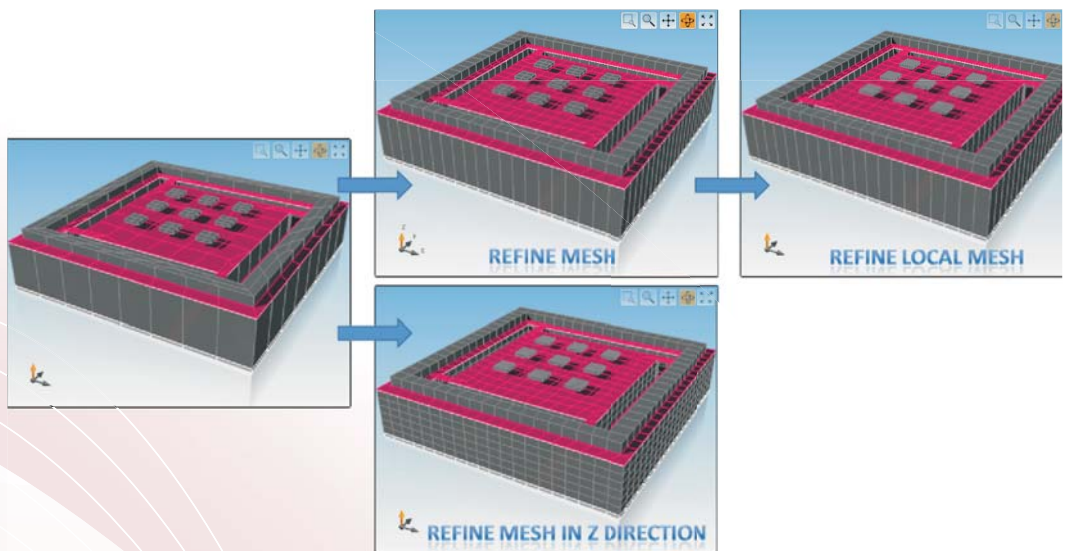


**3D CAD format support capability**

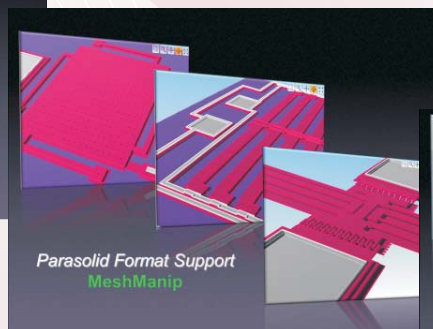
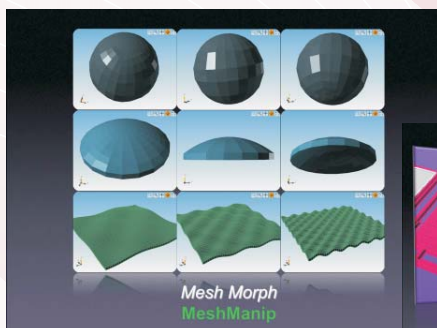
## MeshMorph



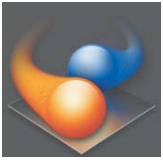
## RefineMesh



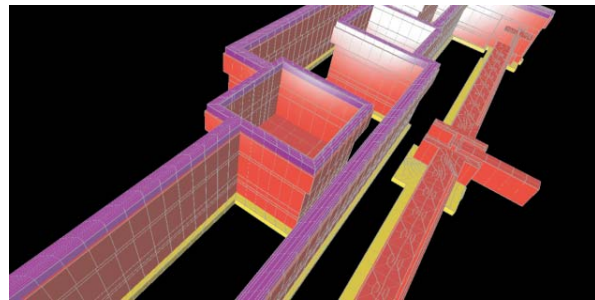
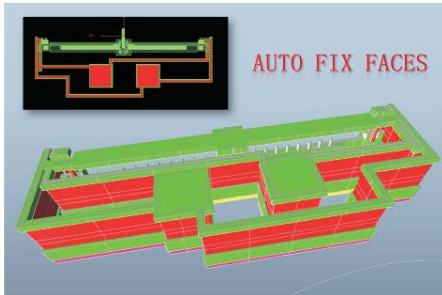
## MeshManip



## Fastfield Multiphysics.



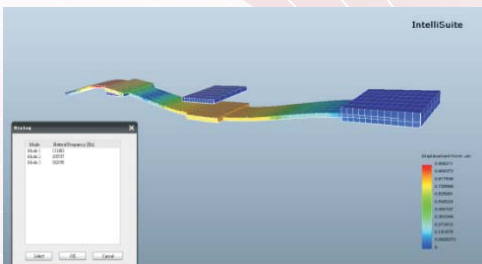
IntelliSuite comes with all the modules that you need to perform fully coupled thermal, electrostatic, fluidic and mechanical simulation and piezo simulation of the MEMS device. An optional module for BioMEMS and Microfluidics analysis is available. Out of the box, you can analyze almost any MEMS device that you can dream up! The IntelliSuite virtual device can be subjected to a combination of inputs, such as electrostatics, electromagnetic fields, temperature, mechanical stresses and pressures, and fluid flow.



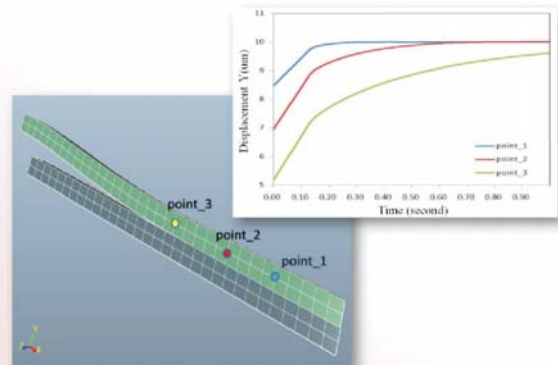
## ThermoElectroMechanical Analysis Module™

The original MEMS multiphysics simulator has received some powerful updates in IntelliSuite v8.7. New coupled package-device simulation capability can be used to analyze packaging effects on a MEMS device. Dynamic contact analysis can be used to simulate models with multiple points of contact. IntelliSuite's powerful reduced-order macromodel extractor can now generate piezoelectric as well as multi-contact macromodels. In addition, the finite element solver has been updated to ensure greater stability and simulation accuracy.

### DynamicContact

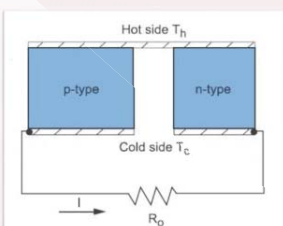


Mode shape of two pair contact

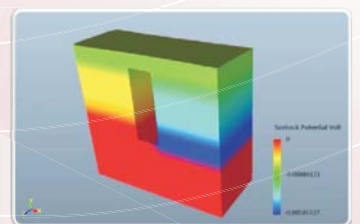
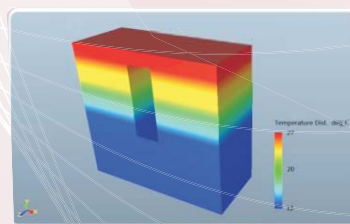
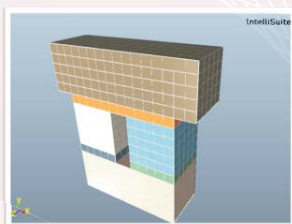


Simulation Results of Displacement of Three Points on the Upper Beam

### Seebeck

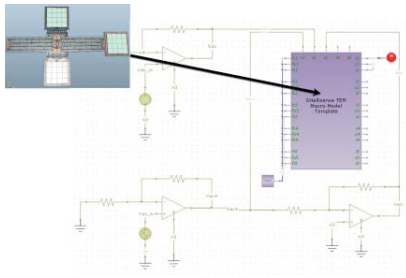


Analysis Model of the Micro Thermoelectric Generator

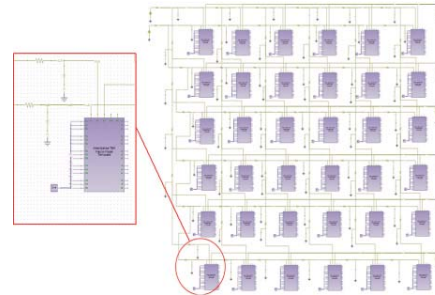


Simulation Results of Temperature (Left) and Seebeck Potential (Right)

**Compact Model Extraction.** IntelliSuite uses state-of-the-art model reduction techniques to automatically create compact system models from large finite element models. NDOF (N-degree-of-freedom) system models encompass coupled electro-mechanical behavior including stress stiffening, electrostatic softening, packaging effects, fluidic and other sources of damping. These accurate compact models can be exported to VHDL, Verilog-A, SPICE, Matlab and other tools for full MEMS-ASIC co-simulation.



System Model Extraction (SME)



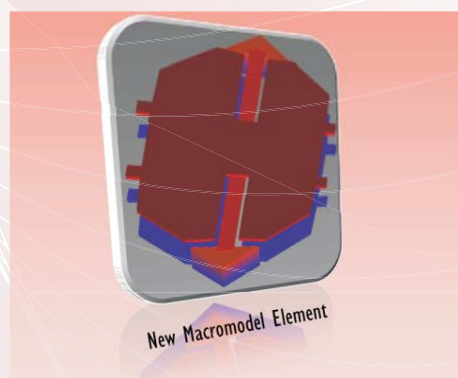
An RC delay circuit to the mirror actuating electrodes

**SYNPLE** allows you to capture your MEMS at a schematic level. Your design can then be quickly iterated and optimized at different granularities. Sophisticated synthesis algorithms can automatically convert your schematic into mask layout, 3D or better yet a meshed structure for full multiphysics analysis.



SYNPLE includes cutting edge schematic capture and simulation tools allowing you to take a hierarchical approach to the design space. SYNPLE provides a large multi-domain library of electrical, mechanical, thermal, and MEMS libraries. These elements may be combined in an effortless drag-and-drop fashion and then wired to create schematics of multi-domain systems. As a result, you can quickly survey a large design space before initiating a detailed analysis and verification process.

Users can perform device-level optimization using Design of Experiments (DoE), Robust Design or other techniques. Built-in place-and-route and synthesis algorithms can be then used to convert the schematic into a mask layout or an optimally hexahedral meshed model ready for full 3D analysis.





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## Total MEMS Solutions

IntelliSense ignited the MEMS industry in the early 1990s with its IntelliSuite® family of innovative CAD/ EDA tools – and is now the leading innovator and supplier of design and development solutions for the MEMS professional. With users in more than 30 countries, IntelliSense offers software tools and custom design, consulting and market research services to universities, blue-chip companies and start-ups worldwide.



What's more, IntelliSense has formed strong affiliations with dozens of leading MEMS foundries and research institutes worldwide, which allow us to prototype and transfer MEMS-based components into production at the lowest cost. As a fabless MEMS company, IntelliSense also offers design, IP licensing and consulting services.