MEMS pro v6.0 Add-ons

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The MEMS Pro v6.0 Add-ons coupled with Tanner Tools Pro provide a flexible, powerful, easy-to-use CAD tool suite for the design and analysis of micro-electro-mechanical systems (MEMS). It offers an integrated solution for the design process that shortens development time while providing designers reliable analysis for manufacture. Functionalities include mixed MEMS/IC schematic capture and simulation, full custom mask layout capability and verification, 3D model generation and visualization, behavioral model creation and links to 3D analysis packages. Foundry design kits are also included.

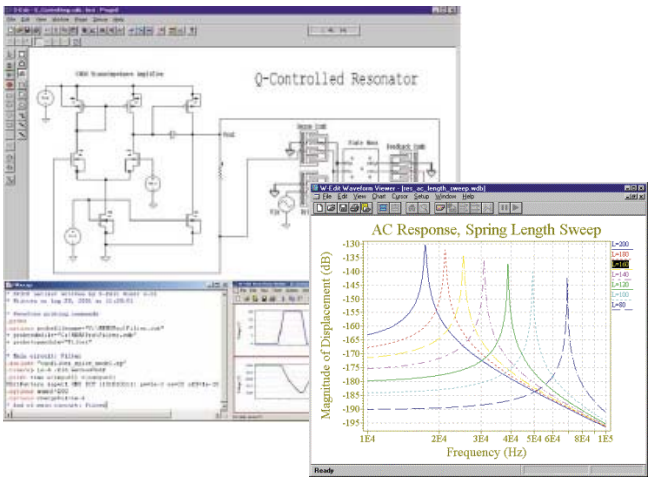
Features

System-level Tools: *The MEMS Pro v6.0 Add-ons together with Tanner Tools Pro* provide system-level design capability through fully hierarchical schematic capture and behavioral level simulation of MEMS devices with electronics and packaging. A library of composable MEMS models is included parameterized by process parameters, material properties and device dimensions. The models are represented with signals in the 6DOF-mechanical, thermal, magnetic, fluidic, optical, and electro-static domains. MEMS models are represented in high level behavioral languages, SPICE, C-code, or data tables.

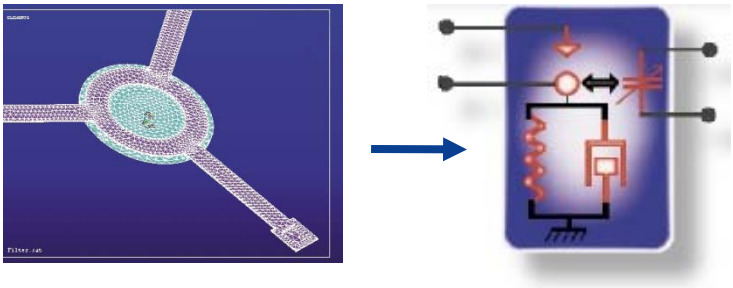
➢Simulation modes include AC, DC operating point, DC transfer sweep, Fourier, Noise, Transient, Transfer function, and Parametric Sweep.

➢Powerful optimization algorithms determine device or process parameters that will optimize MEMS design performance.

➢Statistical analysis allows designers to simulate process corners, run Monte Carlo simulations with statistical distributions of process and geometrical parameters, create response surface models, and perform sensitivity analysis to understand which geometrical or process parameters most effect device performance and estimate yield.



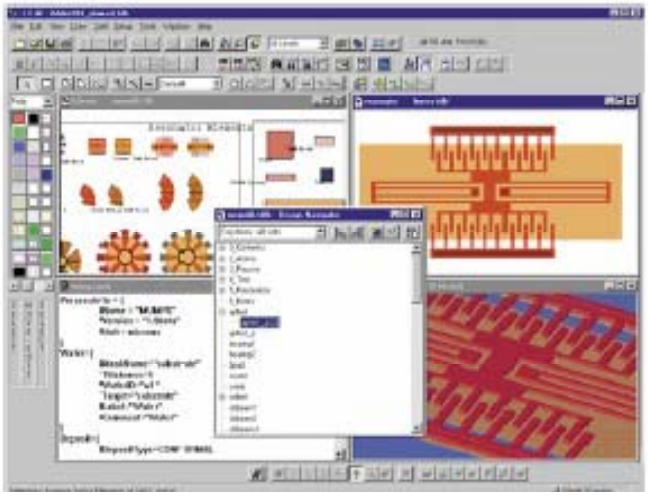
For designs with both MEMS and IC devices, the **MEMS Pro v6.0 Add-ons together with Tanner Tools Pro** allow easy creation and modification of schematics, and generate net lists for simulation, optimization, statistical analysis, and layout verification. The simulation library includes symbols and parameterized behavioral models for a variety of MEMS components. The integrated simulation environment allows users to probe signals of interest on the schematic and simulation waveforms are automatically displayed.



Modeling Tools: *MEMS Modeler* automatically generates behavioral models ready for system simulation with electronics and packaging from 3D data from finite element analysis programs. Complex, finite element models involving a large number of degrees of freedom are reduced to behavioral models with a few master degrees of freedom. Users can also create their own models from analytical equations and the tool generates simulation- ready descriptions in a variety of popular formats.

Foundry Modules enable targeting of specific process technologies, provide process-specific device intellectual property, and are fully integrated with SoftMEMS' tool suites to ensure process compatibility and manufacturability with the world's leading MEMS foundries. Foundry modules include mask and device design rules, mask layer descriptions, device descriptions for extraction, process parameters and material properties, and foundry fabrication process sequence descriptions.

Layout Editing: The MEMS Pro Add-ons and L-Edit provide a physical design environment that includes a fully hierarchical and full custom mask editor engineered for MEMS and IC design. The program uses an intuitive interface and provides specific MEMS-related capabilities that greatly reduce layout time. A curve generator allows designers to create MEMS primitives, such as splines, fillets and general equation-based curves. The **Shape Recovery Tool** recovers shapes such as circles, torii, etc from multi-sided polygons found in formats such as GDS II. A DXF translator is provided for a link with AutoCAD. The **EasyMEMS** tool helps to automate tasks that are time-consuming such as creating polar arrays and generating holes and dimples to properly release MEMS structures.

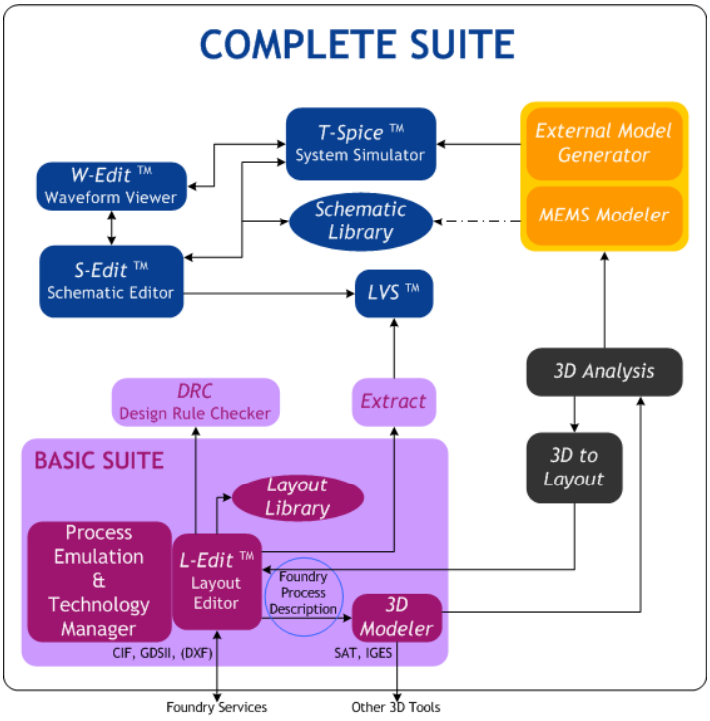


A **Library** of scalable MEMS device layouts is provided through a handy graphical library browser. The library devices are linked to user-specified or foundry design rules to ensure manufacturability. The library includes thermal, mechanical, optical, fluidic, and electrostatic devices. A powerful interface is included for automating, customizing and extending the layout editor using the C language. Popular output formats are supported so designs are "foundry ready".

MEMS Verification modules configure the Tanner **Design Rule Checker** to verify MEMS layout against fabrication requirements to prevent costly design errors. In addition, application and device specific context sensitive rule checking is included. An Extractor generates a SPICE net list from a MEMS layout including MEMS devices, their parameters and multi-domain connectivity. The LVS (Layout vs. Schematic) tool takes the extracted data and compares it against the SPICE netlist from the schematic editor to ensure that the mask layout captures the designer's intent.

The **3D Solid Modeler** creates a 3D view of a MEMS device from a selected layout area and fabrication process description. The **Technology Manager** allows users to enter fabrication process steps and sequences as well as material properties. Surface and bulk micromachining process steps such as material deposit, etch, mechanical polish, diffusion, growth, electroplating and wafer manipulation steps are supported. The 3D model may be scaled, and a subset of mask layers may be selected for view. Models can be viewed with rotations, zooms, preset views, step-by-step display of the fabrication sequence, and can be animated to show process sequences. The **Cross-Section Viewer** displays a cutaway view in the z-dimension based on a user-specified cut line.

Boundary conditions may be defined on mask layout and can be automatically transferred along with either a 2D or 3D model to third party analysis or viewing programs in popular formats (e.g. SAT, APDL and IGES). Models may be "defeatured" for efficient FEM meshing. A MEMS-specific mesher creates efficient meshes for analysis. **3D-To-Layout** converts 3D solid models in ANSYS into 2D mask layouts using user-specified fabrication process descriptions, enabling capture of device mask modifications made in 3D analysis programs.



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