

# Sensors Analysis and Design

CEDRAT's range of software solutions matches ultimately the needs to analyse and design electromagnetic, electroacoustic or electromechanical sensors.

## Electromagnetic sensors

Flux, the leading software for electromagnetic and thermal devices and systems, is the ultimate tool to design and analyse any type of electromagnetic sensors.

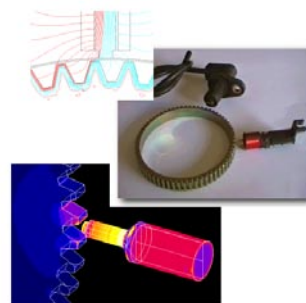
Using the co-simulation link with SIMULINK, the Flux user may easily include a complex drive to his model to simulate a complete sensing system.

Flux features many tools to speed up the simulation and get the most accurate results, for both electromagnetic and thermal computations:

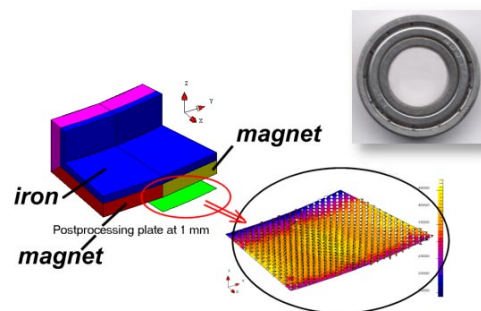
- Geometry building facilities such as import of CAD files (STEP, IGES, DXF...) as well as import of objects (from already defined user library).
- Advanced electric circuit coupling including switches, inductors, capacitors, coil and solid conductors to account for the load and the drive of the device.
- Electromechanical coupling in 2D and 3D to account for the motion of the device during the computation (mass, friction, drag force, spring stiffness...) as well as to compute all mechanical quantities (speed, position, force...).

The different simulation methods (steady state multi-position computation, constant speed or transient response) make Flux a powerful tool to study any configuration of the device.

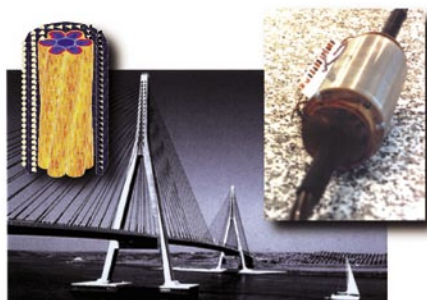
The multiparametric solver of Flux is the ultimate feature to run complete and efficient simulation. It enables the user to compute as many configuration as wished in only one shot by variation of any parameter (geometry, electrical circuit, material...). It enables the user to find easily performance optima as function of every cases's parameter.



ABS Speed velocity sensor.

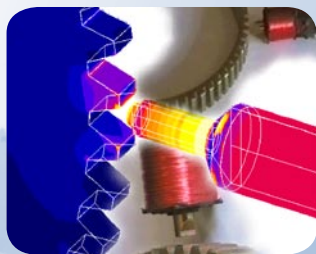


Bearing sensor.



Stress sensor (courtesy of Freyssinet).

Flux multiparametric postprocessor allows to get various results (flux density distribution, currents, voltages, force, speed, position...) in multiple formats (colour shaded maps, 2D/3D curves, isovalues display, AVI animations...).



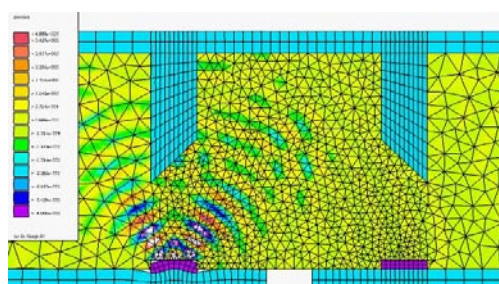
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## Electroacoustic sensors

Thanks to a strong fluid / structure coupling, ATILA is the ideal tool to design electroacoustic sensors.

ATILA contains elements dedicated to modelling the far field acoustic radiation. The fluid/structure coupling can be used in conjunction with the electrical/mechanical coupling. This enables the modelling of immersed electroacoustic transducers.

ATILA's built-in materials database contains a set of materials that are available on the market. This database is the result of 20 years of experience using ATILA. Materials can be added to this database by entering values for the characteristics of any of the materials: elastic, composite, magnetic, piezo-electric, magnetostrictive and fluid. ATILA takes into account dielectric, magnetic, mechanical, and fluid losses.



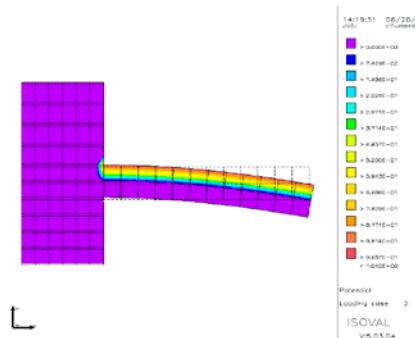
Pressure map of a flowmeter transducer.

## Electromechanical sensors

As for electroacoustic sensors, ATILA features many functionalities for electromechanical sensors, such as accelerometers.

Indeed, ATILA performs computations for structures containing active materials by using a strong electromechanical coupling. The structures are directly actuated by electrical potentials applied on the electrodes.

It can also perform various analyses (static, modal, harmonic and transient). For example, modal analyses provide for each mode the resonance and anti-resonance frequencies, the effective coupling coefficient, which quantifies the electromechanical conversion and the modal damping.



Accelerometer modelled with ATILA.

## References

For any type of sensors, CEDRAT solutions are the reference in many organisations worldwide, such as:

ABB, Alcatel, CEA, Chauvin Arnoux, Contrinex, Crouzet Automatismes, European Synchrotron Radiation Facility, Framatome, Freyssinet, Gemplus, Giat Industrie, Kollmorgen, L'Electricfil Industrie, LEM, Magneti Marelli, Moving Magnet Technology, Matra BAE, Memscap, Microspire, Omron, Sagem, SGS Thomson, Visteon automotive systems, Zertan...

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