

7 modeling and simulation tools, 11 international partners, 30 years of experience and more than 50 engineers, developers and consultants.

With its expertise in the field of Electrical Engineering, CEDRAT and its multidisciplinary team of engineers offers innovative solutions and top of the line tools geared towards the specific needs of each industry. Strong of its tied connections with industries and research institutes, including a close collaboration with G2Elab, CEDRAT focuses on today and tomorrow's goals of energy efficiency, cost reduction and smart features.

Not just tools!

Long term experience in both software development and consulting work make CEDRAT and its distribution network a valuable partner to support and train you when using our softwares. Training and support competencies:

- Use of the programs
- Numerical methods
- Adapted methodology
- Application / Device specific
- Limits of the models' validity
- Customer's models resolution

Consulting services

Lack of competence? Temporary overloaded department? Missing software know-how? Improvement on methodology needed? CEDRAT provides consulting and computation services.

A team of experienced design engineers is available to create, design or optimize innovative solutions. If you are interested in contracting our consulting services, please contact us or visit our website.

Quality assurance

Flux is controlled and developed under Quality Assurance procedures. It ensures a constant validation of the capabilities and the results of the software.

Guiding your Technical Innovation

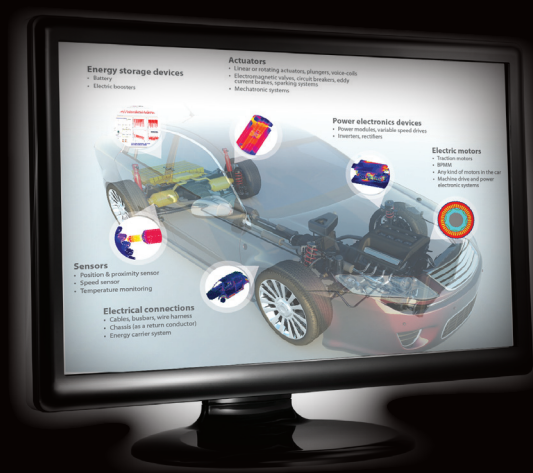
A wide range of applications:

- Automation and drive
- Power electronics
- Electric motors and generators
- Jet engines
- Hybrid vehicles
- Actuators and sensors
- Power supply, UPS...
- ... Adapted to many markets !

References

Industries: Valeo, Schneider Toshiba Inverter Europe (STIE), Schneider Electric, SATIE (ENS Cachan), IRSEEM (ESIGELEC), Maccon GmbH, PSA, Rockwell Automation, HAGER Electro SAS.

Universities: Cambridge University, Laboratoire Ampere - Ecole Centrale de Lyon, Ohio State University, Politecnico di Torino, Universidad Politecnica Valencia, University of Edinburgh, University of Glasgow, IUT de TARBES...



MECHATRONIC SYSTEM SIMULATOR

Multi-domain, multi-physics, multi-level simulation

Evaluating and understanding the system response of individual devices or full systems requires a comprehensive multi-domain tool. With a range of applications that covers power electronics, automation and drive and all electromechanical systems like electric machines, hybrid vehicles, there are almost no limits to the use of **Portunus**.

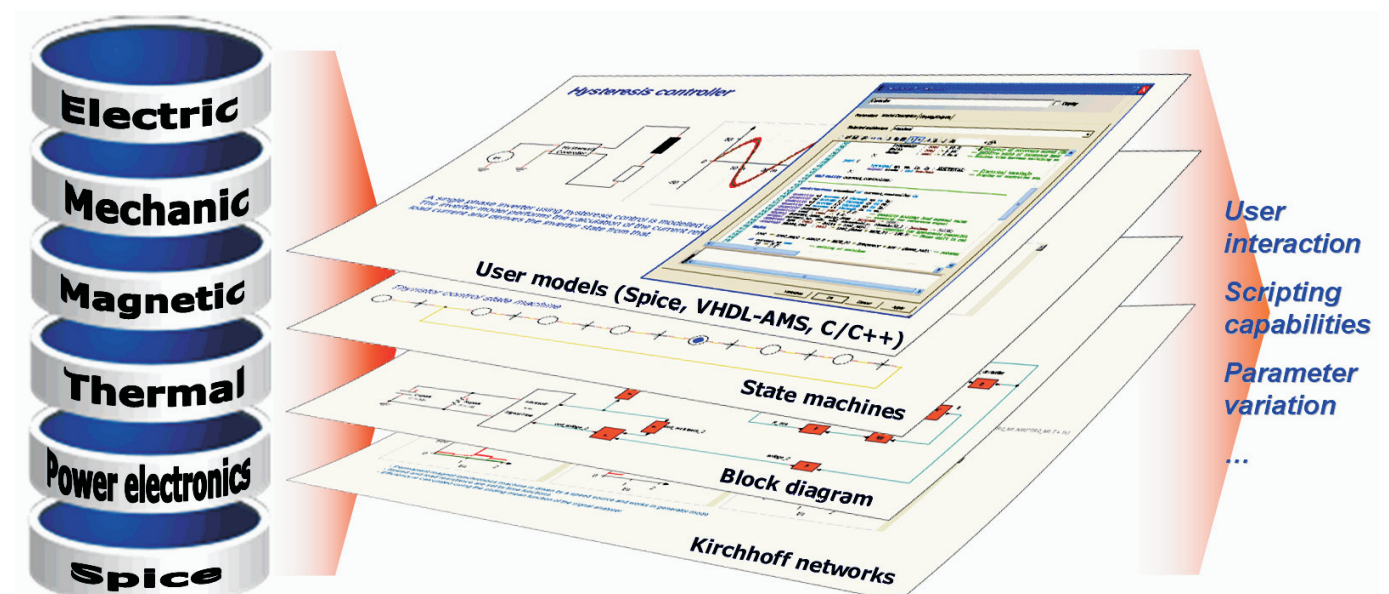
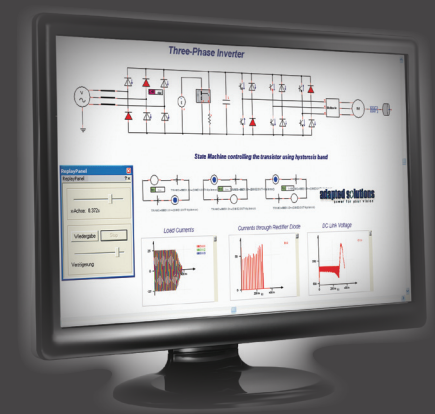
A user-friendly and intuitive interface

The **Portunus** user friendly interface allows more time to focus on analysis rather than on model handling and description. Using a system simulator has never been so intuitive thanks to:

- Modeling, simulation and analysis achieved **in the same window**
- **Ready-to-use complete libraries**
- **Live on-sheet display** of results with integrated post-processing capabilities.
- **Embedded project manager** to gather and share different types of files (pdf, presentations, web links,...) in a database.

*Welcome to the world of
multi-domain simulation!*

Portunus is a unique system simulator to model, simulate and analyse as well applications focused on one domain, as even complete mechatronic systems involving complex multiphysic descriptions.



Welcome to the world of multi-domain simulation!

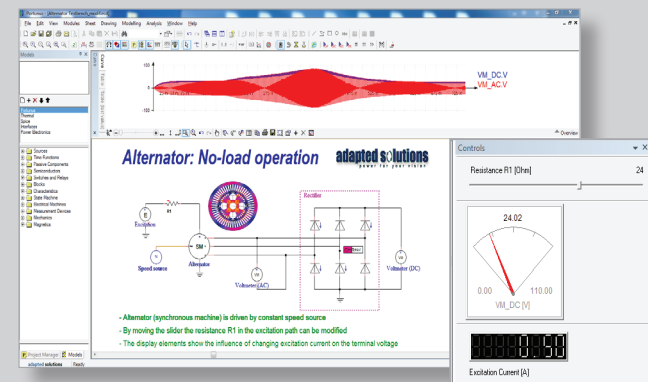
Powerful

The engine you need to power your complex systems

Portunus has the capacity to process your most complicated applications thanks to the handling of:

- **Circuit networks** for electrical, mechanical or thermal applications
- **Block diagrams** for signal flow descriptions
- **State machines** for event-driven simulations
- Complex models coming from **Spice** netlists, **VHDL-AMS** and **C/C++ language**

The powerful combination of modeling techniques taking into account digital, analog and mixed signals is reached by the coupling of two fast and robust solvers.



User interaction and display option for simplified and efficient analysis.

Advanced functionalities

The capacity to simulate complex systems

- **An extensive range of analysis options** for a validation of your complete process

Avoid costly prototypes and long multiple validation process with functionalities that will help you fully understand your system:

- **Parameter sweep** - for automated parameter variation analysis
- **User-interaction** - for direct analysis of parameter impact, parameter adjustment or fault simulation
- **Worst case analysis**

- **Library and model management**

Create and manage your own libraries and implement your specific models coming from subsystems, direct imports in the SPICE or VHDL-AMS format, or user components described with C/C++ code.

- **Scripting possibilities**

Experts will appreciate the scripting possibilities (Visual Basic) to drive **Portunus** from an external environment and perform automated solving processes.

VHDL-AMS

An efficient language for complex system descriptions

Multi-domain simulation is made even more easily with the VHDL-AMS language. Using this IEEE standard description language, designers will benefit from its advantages: **non-proprietary** language (facilitates model exchange between vhdl-ams simulators), mixed (analog and digital), **multi-disciplinary**, **multi-abstraction** (for example the specifications are simulable) and **multi-levels** of modelling ("V" cycle mechatronic designing).

Software synergy

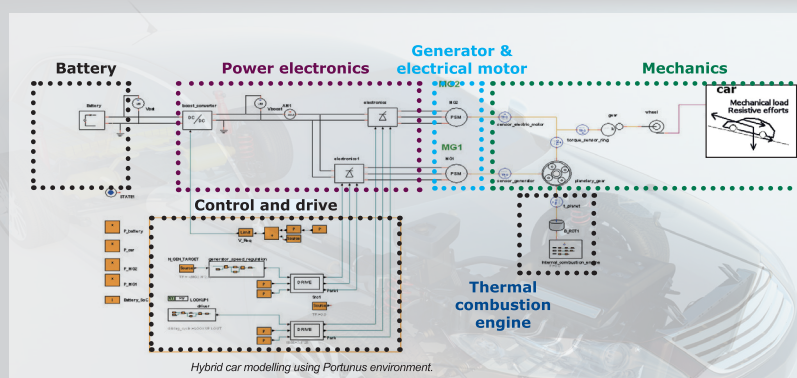
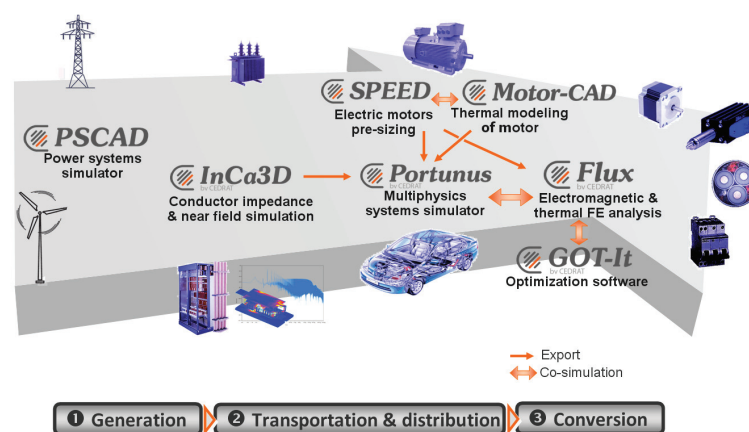
An open software ready to communicate

As part of the CEDRAT software, **Portunus** offers more than a simple system simulator and will allow you to broaden your knowledge of the system through active interaction with existing tools and software.

- **High level co-simulation** to the leading 2D/3D finite element package **Flux** with an unequalled exchangeability of parameters between Finite Element solver and system simulator.
- **Simulink® co-simulation allows:**
 - Data exchange during simulations running in both simulators.
 - To take advantage of Portunus circuit capabilities using your existing Simulink® command models.
- **Keil µVision** co-simulation provides you a virtual hardware platform: a large panel of microcontrollers is available to design embedded system.
- **Got-it** software offers you the possibility to optimize your system (time response, minimize a static error or maximize the efficiency...). It will find the best compromise between all the input data in order to respond accurately to the specifications.

Portunus is open to data coming from our software suite (motor equivalent circuits from **SPEED**, reduced node thermal model from **Motor-CAD**, import RLM Matrix from **InCa3D**) and other existing programs.

From energy generation to final conversion



The capacity to simulate complex systems

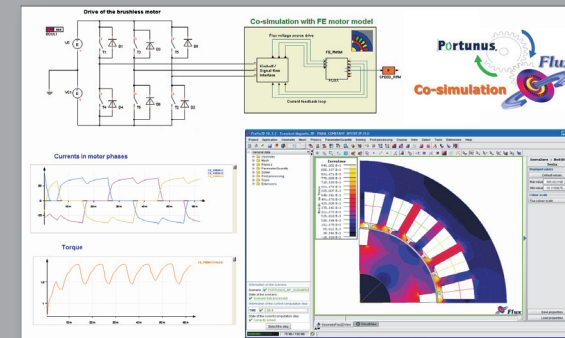
Co-simulation with Flux

Taking into account the effects of the system load or improving its drive now becomes easier thanks to the **Flux/Portunus co-simulation**.

Co-simulation works for **both 2D and 3D models** described in **Flux** and there is virtually **no limitation with the parameters** that can be shared between the two software. Benefits are unlimited and range from the study of load impact (mechanical and electrical loads, thermal effects, etc...) to the design of complex drives.

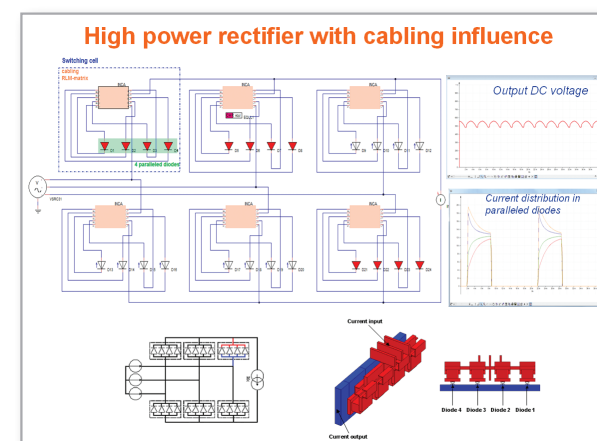
Improving the simulation time considering the needed accuracy, or the nature of the system (its dynamics, if included in an open or closed loop, etc...) is made possible thanks to direct access to **several co-simulation algorithms** that can be parameterized:

- Time step management
- Software synchronization
- Data extrapolation and input variation criteria
- Uncoupling signals by insertion of a delay



More efficiency for power electronics modeling

The Power Electronics Library contains more than 80 models for the simulation of power electronics systems considering all kind of power conversion (AC/DC, ... DC/AC). In addition to predefined network models for typical topologies, a high value is given to providing models for control algorithms. Frequently used algorithms like Park/Clarke transformations, v-f control and sine wave sources with variable frequency and amplitude complete the model set.



High power rectifier modeling with a RLM matrix import from InCa3D: Portunus takes into account interactions between conductors.

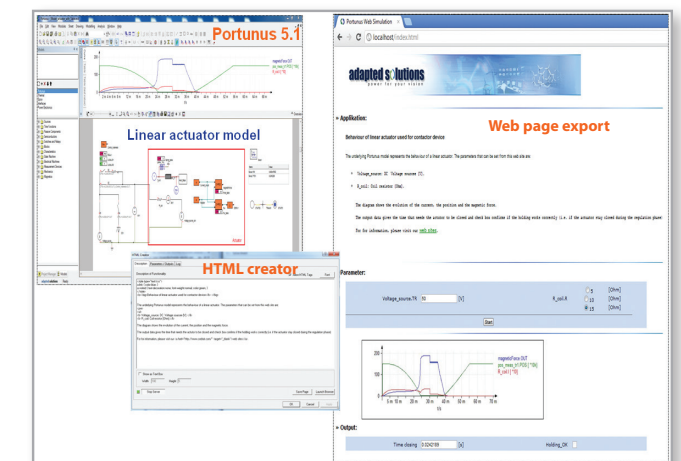
Easy heat transfer simulations with sophisticated thermal models

The thermal library provides a comprehensive set of components that make **thermal modeling easy to perform**. The components come with **intuitive dialogue boxes** to automatically set up the heat transfer formulation from geometry and material data.

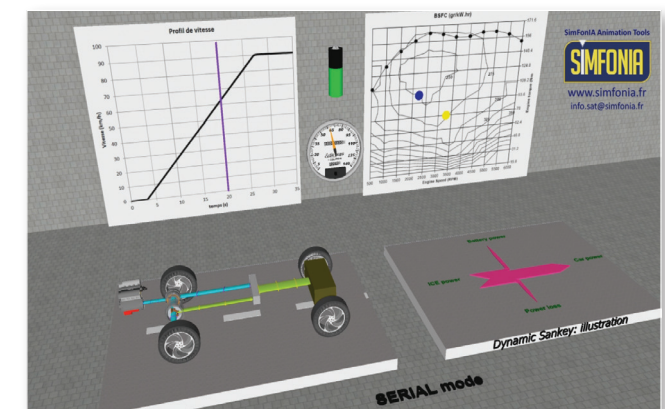
- Thermal networks can be built considering **conduction, convection and radiation effects**
- **Combining electrical and thermal phenomena** is also possible
- **Motor-CAD** users (thermal analysis of motors) can import and expand their schematics

Post-processing

- **Portunus** has improved post-processing results in particular with new graphical curve exploitation, an HTML export for sharing result on the web and a coupling (API link with **Portunus**) with a 3D animation tool developed by SimFonIA (<http://www.simfonia.fr/SAT/>).



The html creator provides a web export and offers you the possibility to make simulations directly from the web.



SimFonIA Animation Tool (SAT) allows to explain theoretical results for non technical public. A full coupling with Portunus (API) is available to insert parameter control in order to interact with the virtual animation..