

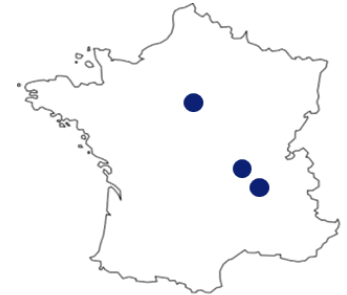
GDR GPL 13 juin 2014

System Simulation software

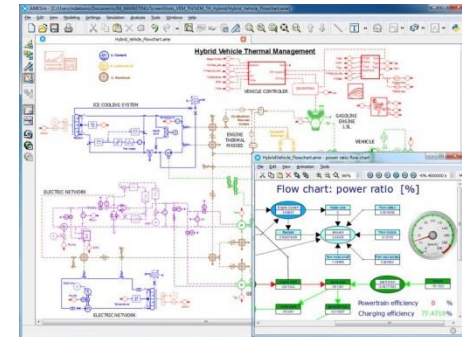
François Gerin & Pacôme Magnin

Siemens Industry Software System simulation French Center of Competence

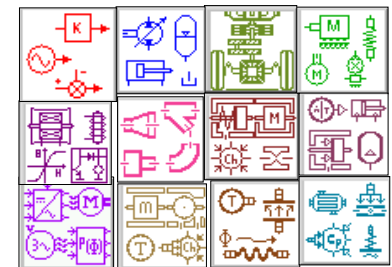
Siemens Industry Software, develops in France (formerly LMS Imagine) the **LMS Amesim multi-domain system simulation solution**.



LMS Amesim allows to model and predict **dynamic mechatronics systems behaviors**, involving **multiple physical domains** (mechanical, fluids, electric, etc.).



Based on bond-graph approach, Amesim integrates a large set of libraries of physical components but also many functionalities (pre&post processing, automation, cosimulation, MODELICA compiler...)



Siemens Industry Software

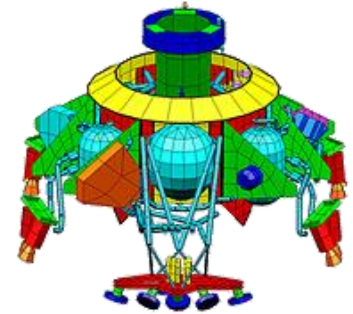
System simulation context and challenges

Product design faces **raising complexity** due to the **exponential growth of design alternatives** driven by technology progress, but also higher **energy efficiency** constraints.

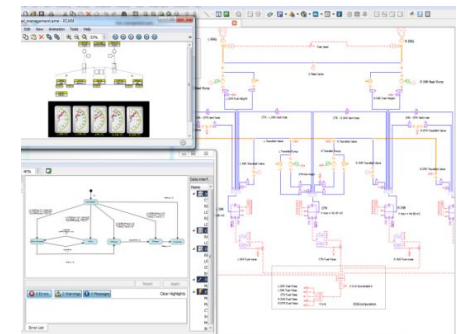
This complexity **impacts** program **costs**, **delays** and **feasibility** up to a **non-sustainable point**.

Engineering strategies mainly address these issues through new **product architectures** (modularization, disaggregation...), **design abstraction** and **automation**.

The future of system engineering widely rely on the support of **system modeling and simulation solutions**.



Copyright: NASA / JPL-Caltech



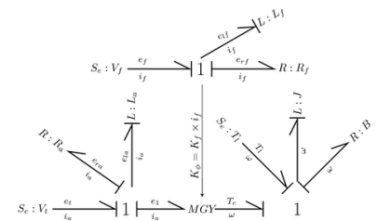
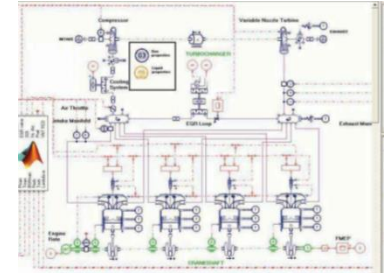
Siemens Industry Software

Collaborative research return of experience

System simulation solutions future challenges involve research activities, but **not limited to software & computing** research:

- From basic research to experimental development
- Involving multiple domains and disciplines
- With the critical need of physical experimentation (validation, reality check...)

That's why **internal research, joint research** and **collaborative research** are the critical path to sustain our system simulation software technical progress, supporting our customers **future needs**.



HD gas engine / Mogano VI research project

Siemens Industry Software

Research through some collaborative projects

- **TOICA** (Thermal Overall Integrated Concept Aircraft)
EC IP research project, led by Airbus, addressing the whole multi-level multi-disciplinary behavioral and thermal simulation of the aircraft.
- **AGESYS** (System engineering workshop)
BGLE French research project led by Esterel, addressing the development of solution supporting system engineering and cross-disciplinary architecture continuity.
- **MODRIO** (Model Driven Physical Systems Operation)
ITEA2 research project led by EDF, addressing the modeling and simulation supporting operational behaviors, but also supporting MODELICA and FMI standards development.
- **IMPROVE** (new EV electric and electronic architecture)
EC STREP research project led by ViF, addressing new EV architecture and subsystems.
- **PRECISION** (Building energy prediction for controls)
ANR French research project, led by IFSTTAR, addressing the building modeling and simulation for smart building predictive controls.



PRECISION

Siemens Industry Software

System Simulation software research perspective

As exposed previously, a **close collaboration** between **software** research and **other disciplines** is a key for achieving results in the system simulation domain.

Such close **cross-disciplinary research** is also representative of the **future of systems engineering**, deeply **integrating controls and physics** (mainly driven by the CPS community).

As relatively young technologies, and regarding the state of the art, system simulation software could face **decades of further challenging research and development**.

The combining of abstraction, complexity of both system simulation technologies and their use cases and the scarcity of competences **make system simulation a field of research and education to be supported**.

