Project Results

Extending interoperability in model-based systems engineering
Reinforcing European leadership in systems modelling and simulation

Managing increasing complexity in embedded software while cutting time to market and improving product quality is essential. The ITEA 2 EUROSYSLIB project has dramatically reinforced European leadership in systems modelling and simulation through enhancement of the Modelica modelling language, its accompanying libraries and infrastructure. EUROSYSLIB developed support for multi-domain applications in aircraft systems, power plants, conventional and electric vehicles with interoperability between tool boxes and a huge extension of the Modelica libraries. The results are available through the Modelica Association and commercial tool suppliers.

Systems modelling involves behavioural and dynamic modelling in any engineering domain including control systems. EUROSYSLIB focused on embedded systems modelling and simulation. The objective was to cut costs and increase productivity while meeting relevant specifications and user expectations.

The ITEA 2 project, initaited and lead by Dassault Systèmes, involved designing, optimising and checking the behaviour of future products as early as possible in a virtual environment with a multidisciplinary team.

The EUROSYSLIB approach optimises product dynamic behaviour and geometric constraints concurrently in the same framework – offering a digital mock-up of a system with view on its behaviour.

SOLVING DIFFICULT ENGINEERING PROBLEMS
Modelica is a powerful, open, modelling language which supports integrated modelling over all systems and physical domains. It can handle the most difficult tasks, in particular:

- Multidisciplinary problems involving simultaneously technologies from multiple domains such as: mechanics, hydraulics, pneumatics, thermodynamics, flow dynamics, electrical and software;
- Problems involving highly coupled components, where traditional hierarchical design does not work or does not make it possible to reach optimal designs;
- Problems involving hybrid mathematical resolutions such as continuous-discrete modelling and simulation; and
- Discontinuous and variable structure systems.

Models are structured in the way engineers think: with Modelica, the problem is described rather than the way to a given solution. Complex systems can be designed by assembling components. This makes it possible to model and simulate complex, continuous-discrete, discontinuous and variable structure systems very quickly by just connecting such components together.

The result is a major gain in productivity with the ability to solve many multidisciplinary problems not addressed before.

ENHANCEMENT AND EXPANSION
The language was enhanced and expanded

Modelica vehicle system model

EUROSYSLIB
(ITEA 2 ~ 06020)

■ **Partners**
ABB
Austrian Institute of Technology
Claytex Services
Dassault Aviation
Dassault Systèmes
Deutsches Zentrum für Luft- und Raumfahrt
Dynasim
EDF
Fraunhofer IIS
IFP
INRIA
Kämmerer
LMS Imagine
Lund University
Modelon
Schneider Electric
Siemens Power Generation
XRG Simulation
ZF Friedrichshafen

■ **Countries involved**
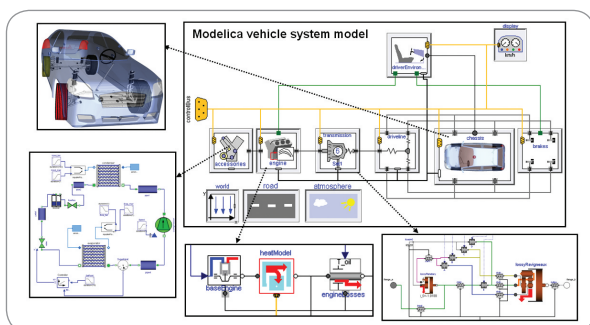Austria
France
Germany
Sweden
UK

■ **Project start**
October 2007

■ **Project end**
June 2010

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Project Results

to ensure full coverage of market needs. Modelica users also required access to a sufficiently large number of libraries comprising off-the-shelf design components. This required large-scale co-operation through a network of 19 European companies developing new innovative Modelica libraries.

Work focused on:
1. Library infrastructure;
2. Mechanical systems;
3. Electrical and electronic systems;
4. Thermo-fluid systems;
5. Control systems;
6. Properties and safety modelling; and
7. Vehicle systems.

Major outcomes include extensions of the Modelica language and a set of high-value, innovative modelling and simulation libraries. Modelica was integrated into Dassault Systèmes CATIA and ENOVIA tools and the LMS Imagine AMESim tool. Improvements were made to the Dynasim Dymola and INRIA Scicos tools. And an interface was developed between Dassault's SIMULIA tool and the Modelica Flexible Bodies library.

Overall, EUROSYSLIB developed 13 open-source libraries, 18 commercial libraries and 13 software enhancements covering electrical and electronic, thermo-fluid, control and vehicle systems. Standardisation of language developments was carried out through the Modelica Association which adopted ten major extensions. Guidelines were produced for future library development s and have been proposed to the Modelica Association.

EXPLOITATION UNDERWAY
Exploitation for most of the results is underway. Open-source libraries are distributed via the Modelica Association (www.modelica.org/libraries); commercial libraries are distributed by Dassault Systèmes, LMS International, Bausch-Gall and Claytex.

Commercial software enhancements developed in EUROSYSLIB are included in the products of Dassault Systèmes and of LMS International. Extensive dissemination was carried out during the project. Dassault Systèmes plans to host an open Modelica community platform to continue the work.

Major project outcomes

DISSEMINATION
- 3 Journal articles
- 40 Conference articles
- 10 Presentations at conferences and workshops (without articles)
- 2 Booths at fairs (FISITA 2008, Automatica 2010)
- 2 Booths at ITEA Symposia

EXPLOITATION
- 13 Open Source Modelica Libraries
  distributed by the Modelica Association - www.Modelica.org/libraries
- 18 Commercial Modelica Libraries
  distributed by Dassault Systèmes, LMS International, Bausch-Gall, Claytex
- 13 Commercial software enhancements
  distributed in the products of Dassault Systèmes and LMS International

STANDARDISATION
- 10 major extensions proposed to and accepted by the international non-profit Modelica Association (included in the Modelica language versions 3.1 and 3.2)

EUROSYSLIB
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