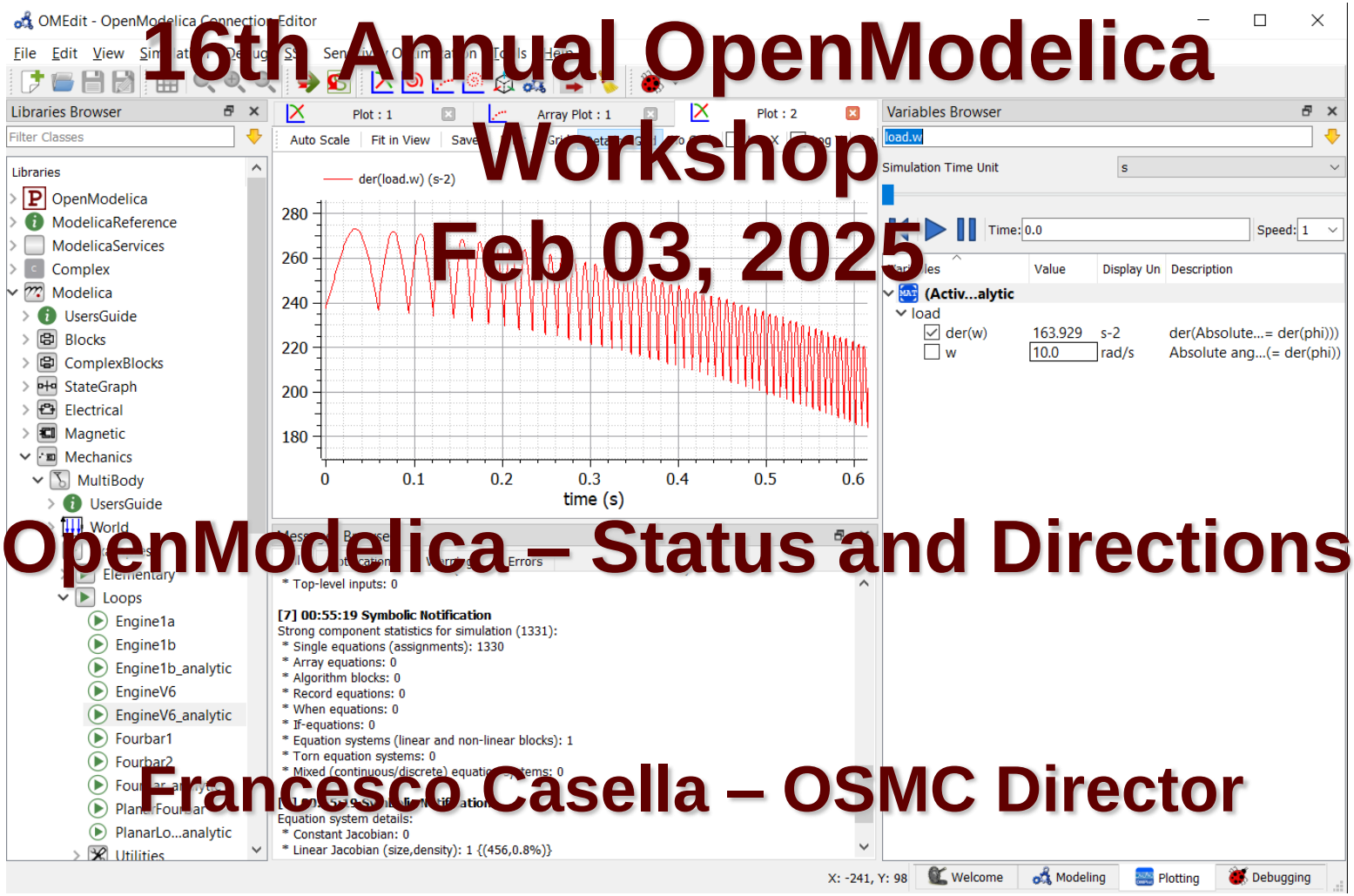
16th Annual OpenModelica Workshop
Feb 03, 2025



OpenModelica – Status and Directions

Francesco Casella – OSMC Director

Goals for the OpenModelica Effort

- Comprehensive **modeling, simulation and systems engineering** environment for research, teaching, and industrial usage
- **Open-source** for both **industrial** and **academic** usage
- Invitation for **open-source cooperation** around OpenModelica, tools, and applications
- **Increasing** emphasis on **industrial** usage

OpenModelica Releases in 2024

- Version **1.22.2** released 21 Feb 2024
- Version **1.22.3** released 11 Mar 2024
- Version **1.23.0** released 06 Jun 2024
- Version **1.23.1** released 04 Jul 2024
- Version **1.24.0** released 09 Oct 2024 (ahead of time)
- Version **1.24.2** released 15 Nov 2024
- Version **1.24.3** released 14 Dic 2024

OpenModelica Releases in 2024

- BaseModelica output, also from the command line
- Many improvements in OMEdit usability
- Improved FMI export
- Over 200 issues fixed

Collaboration with LBL on Buildings/IBPSA

- Strategic partnership started in 2021 with LBL (US gov't laboratory in Berkeley)
- Goal: provide open-source support for Modelica libraries (Buildings, IBPSA) involved in the Spawn of Energy Plus project

- **100% Build success on Buildings and IBPSA**

  (except a few cases with expandable connectors)
- **97% Simulation success on Buildings, 99% on IBPSA**
- **Systematic analysis of remaining issues with Buildings and IBPSA**

  Currently about 20 remaining issues to be solved
- **36 Buildings-specific issues solved since the 2023 Workshop**

Collaboration with RTE

- Four-year DFD contract signed Jul 2023 – June 2027
  - OMC maintenance and support
  - OMEdit enhancements
  - Efficient code generation for large-scale systems
  - Improved debugging

- **On-going work**
  - **Upgrading of Dynawo production code to OMC 1.25.0**
  - **Support for standalone Dynawo Modelica library in OMEdit**
  - **Efficient generation of simulation code for large models using the new backend**

Status of New Frontend

- OMC can now flatten **100% (*)** of the models in the following OS libraries:

  Buildings, BuildSysPro, BuildingSystems, Chemical, ClaRa, DeltaRobot, EHPTLib, ExternalMedia, HanserModelica, HelmholtzMedia, IBPSA, IDEAS, IndustrialControlSystesm, MEV, ModelicaByExample, Modelica (3.2.3 & 4.0.0), ModelicaTest, Modelica_DeviceDrivers, OpenHydraulics, OpenIPSL, PNLib, PhotoVoltaics, PhotoVoltaics_TGM, PyhsioLibrary, PlanarMechanics, PowerGrids, PowerSysPro, PowerSystems, ScalableTestGrids, ScalableTestSuite, SystemDynamics, StewartPlatform, ThermoPower, TILMedia, ThermoFluidStream, VehicleInterfaces

  (*) excluding models with illegal Modelica code and a few cases using expandable connectors

- Array-preserving flattening
- Instance-based support for OMEdit graphical model editing
- BaseModelica output (`--BaseModelica`)
- Very stable and fast.
- Missing features:
  - Full support of expandable connectors
  - Support of state machines

Status of Backend, Code Generation & Runtime

- On-going work on **new backend**, with more rational structure and including array-preserving analysis and code generation. Major improvements in adjacency analysis
- The new backend can already compile simple array-based models with over **3.2 million equations** in a few minutes - almost ready for large-scale power grid models
- Power grid models can be now be compiled with the new backend – missing pieces: sparsity analysis and support of sparse solvers
- New diagnostic feature for Newton-Raphson solver failures – see talk later today

Improvements to OMEdit GUI

- Proper rounding of decimal digits in parameter editing
- Top-level and hierarchical parameter editing in OMEdit
- Full-fledged out-of-package Duplicate feature
- Reload Feature
- Right-click open class in text wiew
- Faster diagram editing in OMEdit
- **120** issues resolved on the master branch since Feb 5 2024
- Upcoming 1.25.0 release with the latest improvements and bug fixes

OSMC Plan of Operations for 2025 (1 of 2)

- Further increased library coverage, performance, and quality with special focus on the Buildings library in collaboration with LBL
  - Achieve 100% successful simulation of Buildings 12.x.x
  - Further FMI export reliability on Buildings models
  - Assess quality of simulation results and improve simulation performance
- Improved handling of expandable connectors in the New Frontend
- New Backend enabling fast compilation of large-scale power system models & other large models (significant support by RTE)
  - Improve coverage of libraries by the New Backend
  - Fast code generation with array-preserving methods
  - Run-time resizable arrays
  - Support event handling and improve efficiency compared to old backend
  - Support efficient multi-rate integration by selective evaluation of the ODEs RHS
- OMEdit new features:
  - Further improvements in speed of response when editing large models
  - Rename function with refactoring
  - Re-designed Simulation Setup interface
  - Supporting new MLS3.6 features (selected model removal)

OSMC Plan of Operations for 2025 (2 of 2)

- Improvements in simulation speed for large systems via multi-rate integration, including hybrid systems
- Integration of runtime data in the OMEdit debugger
- Improved support for commercial libraries
  (Including libraries from Bosch-Rexroth, XRG, TLK-Thermo, etc.)
- Improved FMI export, including FMI 3.0.x features
- Partial FMI 3.x and SSP 2.x support in OMSimulator
- Follow development of Base Modelica standard when released
- Important progress on the Julia-based OMC implementation and come to some kind of conclusion about what we want to do with it
- Migrate state machines and MetaModelica support to NF
- Exploratory work for detailed detection of structural singularity causes; also consider enforcing balancedness detection in the frontend, according to Modelica 3.x rules
- Improved support for data reconciliation (continuation of OpenCPS)
- Improved support of CRML extension for requirement specification
- Planned releases:
  - 1.25.0 February 2025
  - 1.26.0 July 2025
  - Patch releases if critical bugs are found in released versions

The Open Source Modelica Consortium

Purpose of the Consortium

- The Open Source Modelica Consortium, created the 4th of December 2007 in Linköping, Sweden, in the following called OSMC, is a non-profit, non-governmental organization with the aim of developing and promoting the development and usage of the **OpenModelica open source implementation of the Modelica computer language** (also named Modelica modeling language) and OpenModelica **associated open-source tools and libraries**, collectively named the OpenModelica Environment, in the following referred to as OpenModelica**.**

- OpenModelica is **available for commercial and non-commercial usage under the conditions of the OSMC Public License**. It is the aim of OSMC, within the limitations of its available resources, to provide **support and maintenance of OpenModelica**, to support its publication on the web, and to **coordinate** contributions to OpenModelica.

Open Source Modelica Consortium Originally Created Dec 4, 2007

7 Founding Organizational Members

- Bosch-Rexroth AG, Germany
- Equa Simulation AB, Sweden
- TLK Thermo, Germany
- VTT, Finland
- Linköping University, Sweden
- Hamburg University of Technology/TuTech, Institute of Thermo-Fluid Dynamics, Germany
- Technical University of Braunschweig, Institute of Thermodynamics, Germany

OSMC 55 Organizational Members, Jan 2025
(initially 7 members, 2007)

Companies and Institutes

- ABB AB, Germany
- Berkeley Lab, California, USA
- Bosch Rexroth AG, Germany
- Creative Connections, Prague
- DEMXS, Shanghai, China
- DHI, Aarhus, Denmark
- Dynamica s.r.l., Cremona, Italy
- EDF, Paris, France
- Fraunhofer IWES, Bremerhaven, Germany
- Fraunhofer FCC, Gothenburg, Sweden
- GSIMX Beijing Technology, China
- HOERBIGER Wien GmbH, Vienna, Austria
- INRIA, Rennes, France
- ISID Dentsu, Tokyo, Japan
- Maplesoft, Canada
- NCDC, Wuhan China
- Orthogonal Supersystems, Germany
- RTE France, Paris, France
- Saab AB, Linköping, Sweden
- Shanghai Duanyan Information Techn., China
- SIL3X, Paris, France
- Simtek, Nanjing, China
- SmartFluidPower, Modena, Italy
- Swegon AB, Gothenburg, Sweden
- TLK Thermo, Braunschweig, Germany
- Volvo Cars AB, Sweden
- VTI, Linköping, Sweden
- XRG Simulation GmbH, Hamburg, Germany

Universities

- Augsburg University, Germany
- Australian National University, Australia
- Hochschule Bielefeld, Bielefeld, Germany
- University of Bolivar, Colombia
- University of Buenos Aires, Discrete Sim. Lab, Argentina
- TU Braunschweig, Germany
- Univ Catalunya, Spain
- Chalmers Univ, Control,Sweden
- Chalmers Univ, Machine, Sweden
- TU Delft, Netherlands
- TU Dresden, Germany
- Université Laval, Canada
- TU Hamburg/Harburg Germany
- IIT Bombay, Mumbai, India
- K.U. Leuven, Belgium
- Univ Linnaeus, Sweden
- Linköping University, Sweden
- Univ of Maryland, Syst Eng USA
- Univ of Maryland, CEEE, USA
- Politecnico di Milano, Italy
- Mälardalen University, Sweden
- Univ. Pisa, Italy
- Rennslaer Polytechnic Institute, Troy, USA
- Univ SouthEast Norway
- Vanderbilt Univ, Nashville, USA

Organizational Members Update 2024

- New members:
  - DEMXS Shanghai China
  - Simtek Nanjing China
  - SIL3X, Paris, France
  - NCDC, HUST, Wuhan, China
  - Orthogonal Supersystems GmbH, Germany
  - Festo SE & Co. KG, Germany

Open Source Modelica Consortium Individual Members (74 individual members)

- Peter Fritzson, Adrian Pop, Martin Sjölund, Per Östlund, Peter Aronsson, Adeel Asghar, Mikael Axin, Bernhard Bachmann, Vasile Baluta, Adam Bergmark, Robert Braun, Willi Braun, David Broman, Stefan Brus, Francesco Casella, Filippo Donida, Atiyah Elsheikh, Jens Frenkel, Mahder Gebremedhin, Daniel Hedberg, Michael Hanke, Hao Hong, Lv Hong, Zoheb Hossain, Alf Isaksson, Kim Jansson, Daniel Kanth, Tommi Karhela, Juha Kortelainen, Abhinn Kothari, Petter Krus, Rahul Jain, Alexey Lebedev, Oliver Lenord, Ariel Liebman, Rickard Lindberg, Håkan Lundvall, Abhi Raj Metkar, Eric Meyers, Tuomas Miettinen, Afshin Moghadam, Kenneth Nealy, Maroun Nemer, Hannu Niemistö, Peter Nordin, Kristoffer Norling, Lennart Ochel, Arunkumar Palanisamy, Karl Pettersson, Pavol Privitzer, Reino Ruusu, Per Sahlin,Wladimir Schamai, Gerhard Schmitz, Sunil Shah, Alachew Shitahun, Magnus Sjöstrand, Anton Sodja, Ingo Staack, Kristian Stavåker, Sonia Tariq, Mohsen Torabzadeh-Tari, Parham Vasaiely, Niklas Worschech, Robert Wotzlaw, Björn Zackrisson, Azam Zia

Open Source Modelica Consortium – OSMC Board of Directors 2024

- **Rüdiger Franke**, OSMC Chairman; Manager, ABB AG, Germany
- **Oliver Lenord**, OSMC Vice Chairman; Project manager, Germany
- **Francesco Casella**, OSMC Director; Prof, Politecnico di Milano, Italy
- **Peter Fritzson**, OSMC Vice Director; Prof, Linköping Univ, Sweden
- **Juha Kortelainen**, Manager, VTT, Finland
- **Arne Speerforck**, Prof, TU Hamburg-Harburg, Germany
- **Adrien Guironnet**, Manager, RTE, France
- **Niklas Worschech**, Techn. Specialist, Bosch-Rexroth, Germany.
- **Audrey Jardin**, Techn. Manager, EDF, France
- **Bernhard Bachmann**, Prof, Hochschule Bielefeld, Germany
- **Adrian Pop**, adjoined to the Board, Tech coordinator, OSMC

OSMC Board – 2 Meetings During 2024

Meeting dates

- 17/06/2024
- 5/11/2024

Board Work

- Planning and prioritizing the OSMC work
- OSMC Business models
- Licensing issues
- Admitting new members
- Planning the workshop
- Budget
- etc.

Some Supporting Research Projects 2024

- PHyMoS - Proper Hybrid Models for Smarter Vehicles. German national project including Bosch, LTX, XRG, TLK, ESI ITI GmbH, Modelon, TU Braunschweig, Universität Augsburg, FH Bielefeld. 2021-2024
- Swedish project ELLIIT Cloud Tooling for Large-Scale Cyber-Physical System Model-Based Development (one 5-yrs PhD)
- ITEA4 project OpenSCALING, “Open standards for Scalable Virtual Engineering and Operation”, 2023-2026

Special Thanks

- The developers who worked very hard during 2024 and modelers who tested and gave important feedback
- The OpenModelica consortium organizational members for their support
- RTE, LBL, EDF for their extra support during 2024 through DFD contracts
- Master's and PhD students who made important contributions.
- Online contributors to the code base that we never had a chance to meet in real life.

Conclusions and Summary 2024

- Jun 24, 2024. OpenModelica **1.23.0**
- Oct 9, 2024. OpenModelica **1.24.0**
- Dec 16, 2023. OpenModelica **1.24.3**
- Towards a standard **high performance**, **quality, compliant** open source Modelica implementation

- **Expected OpenModelica 1.25.0 and 1.26.0/2.0.0** in 2025

Questions?

www.openmodelica.org