User Survey Among OSMC Organizational Members

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OpenModelica

Methodology

- Two calls issued on 10 Jan and 23 Jan 2018 via osmc@ida.liu.se
- Targeted to organizational members, one reply per member
- Survey carried out on SurveyMonkey.com
- 10 questions, 18 minutes on average to reply

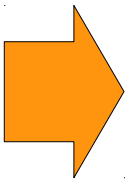
Q1: Name your organization

13 Companies

Berger IT-COSMOS GmbH
Bosch Rexroth AG
Dynamica srl
EDF
EQUA Simulation AB
Robert Bosch GmbH (Corporate Research)
RTE
Siemens AG
Siemens Industrial Turbomachinery AB
SKF
TLK-Thermo GmbH
VTT Technical Research Centre of Finland Ltd
Wolfram MathCore AB

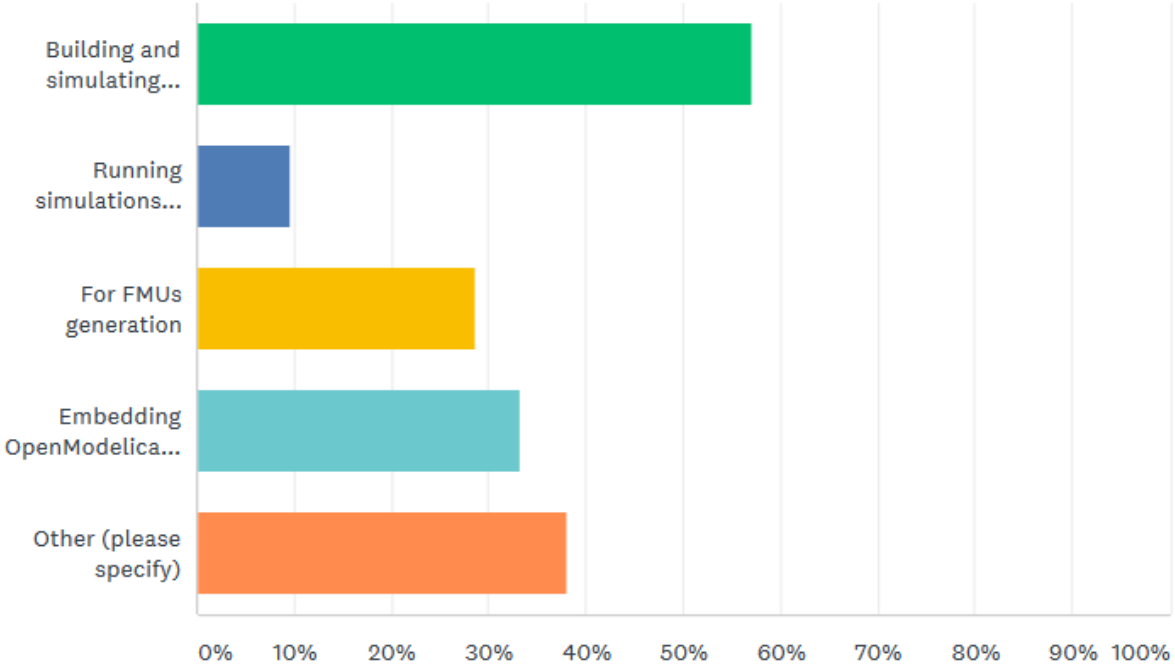
8 Universities

FH Bielefeld
Hamburg University of Technology,
IIT Bombay
Politecnico di Milano
Tecnológica de Bolívar University - Colombia
Technische Universität Dresden,
University of Pisa;
Westfälische Hochschule



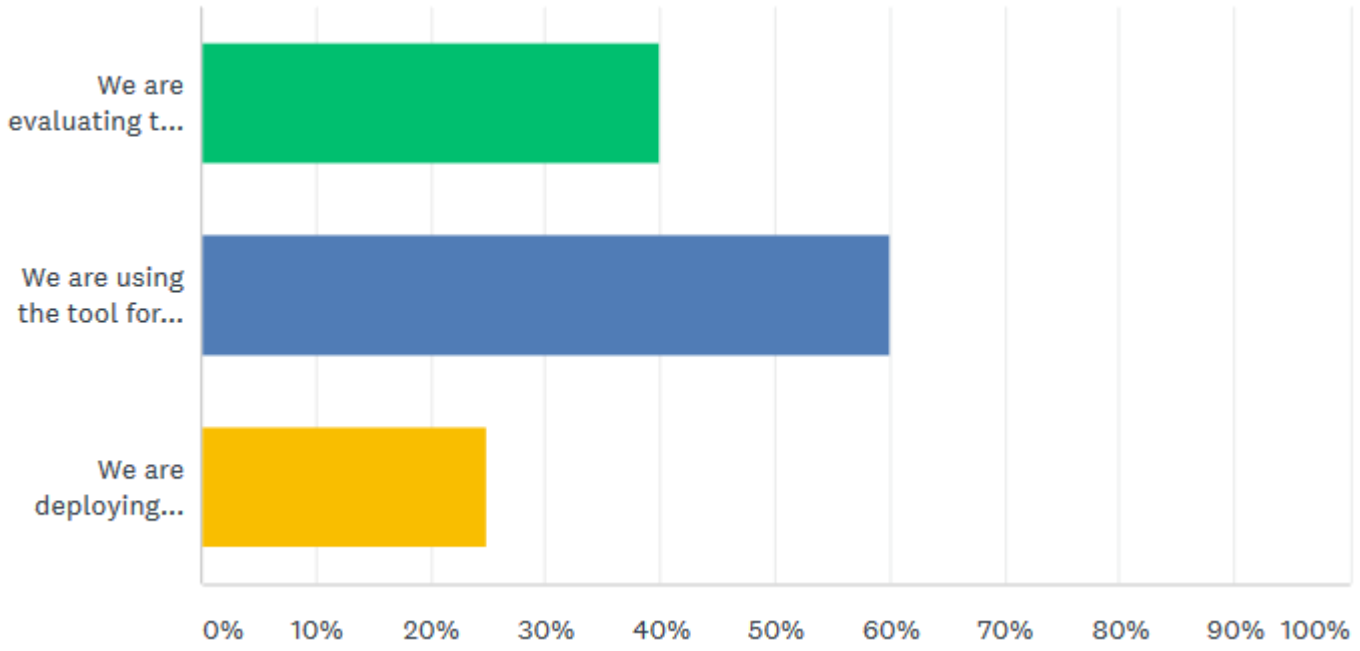
40% of OSMC members

Q2: How is OpenModelica used in your organization?



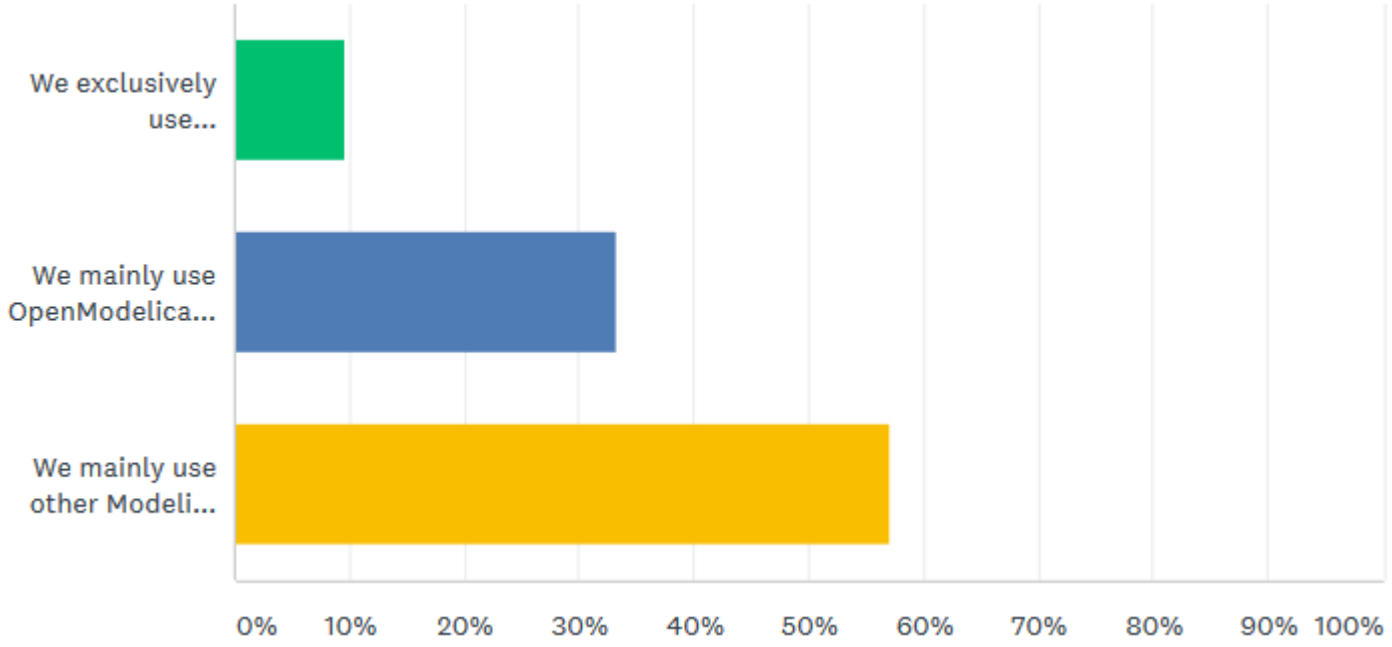
ANSWER CHOICES		RESPONSES	
Building and simulating models using OMEdit		57.14%	12
Running simulations from the command line or CORBA/Python interfaces		9.52%	2
For FMUs generation		28.57%	6
Embedding OpenModelica within own tool(s)		33.33%	7
Other (please specify)	Responses	38.10%	8

Q3: At which level is OM used in your organization?



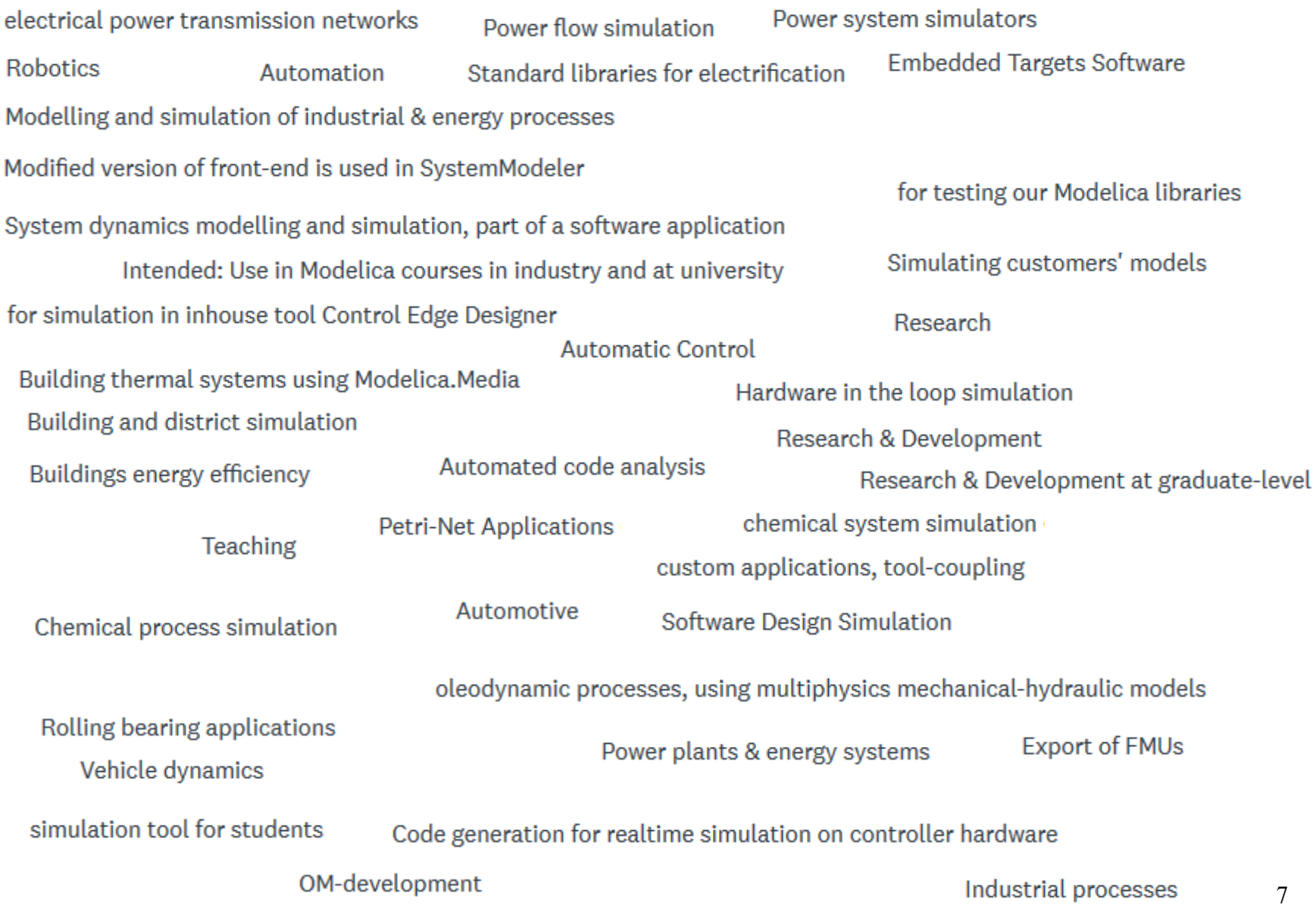
ANSWER CHOICES	RESPONSES	
We are evaluating the tool but not yet using it for serious work	40.00%	8
We are using the tool for internal development of products and services	60.00%	12
We are deploying OpenModelica technology at our customer's sites for them to use	25.00%	5

Q4: Use of Modelica tools in your organization



ANSWER CHOICES	RESPONSES	
We exclusively use OpenModelica	9.52%	2
We mainly use OpenModelica but also other Modelica tools	33.33%	7
We mainly use other Modelica tools but also use OpenModelica	57.14%	12

Q5: Areas of applications of OpenModelica



Q6: Successful Applications

First success with Software Designsimulation. Challenging requirement to find design faults in early stage of developement was resolved with modelica's State Machine simulation. Still help with Dymola is needed, since Stategraph editing is under developement in OpenModelica (used nighty build version)

Modelling of a large construction robot. The main advantages in the use of OpenModelica were the easy integration of hydraulic and multibody domains and the modelling of complex, closed loops transmission chains. The robot model was also successfully used for control systems design. Modelling of anaerobic digestion in biogas power plants. OpenModelica was used to develop both an accurate (ADM1 model) and a simplified (AMOCO) anaerobic digestion model, to be used for process optimization and control system design. Modelling and simulation of an innovative molten-salt powered once-through boiler-turbine system for solar applications. We used OpenModelica to compile the model into an FMU that could be freely redistributed among the EU project partners Modelling and simulation of large-scalee power generation and transmission systems. We helped Dynamica s.r.l. tto develop prototypes of grid simulators for major EU transmission system operators, and pioneered the use of daeMode in this field

Battery models library for evaluating the efficiency & range in transportation applications

OpenModelica is used as the simulation solver in the Simantics System Dynamics Tool, an open source system dynamics modelling and simulation environment. The tool is widely used worldwide.

Not yet but We have some promising tests of our applications.

See Control Edge Designer from: https://openmodelica.org/openmodelicaworld/related-products. We needed a fast system simulation for the hydraulic systems. This was achieved by the easy integration of the OMC-translated valve models in our tool.

(Semi-) automatic code analysis (structure, parameters, annotations) via Python interface and scripting commands: Comparison of Dymola and OpenModelica to fulfil this task. OpenModelica offered more good scripting commands and the ability to check the source code in case of unexpected behaviour. In the end, OpenModelica appeared to be a more sustainable solution. (Dymola commands, however, seemed to cover some features more reliably.)

Q6: Successful Applications (cont'd)

Development of a thermal model of a coolant circuit. The model library was developed and the system model validated using OMEdit. The transformed equations were extracted using the dae dump. The bipartite graphs were used to determine the tearing variables and the dummy states of the index reduced DAE.

> Over recent years Openmodelica has improved a lot. During the last 5 years its usage has first appeared in my Department as a tool able to make good simulations, but only in rare cases able to substitute commercial Dymola. Then the areas in which OM was a valid substitute of Dymola have increased. Now we are around 80% of the models we use. Currently it is good for teaching and research. However its usage in research is jeopardised by the poor support of complex numbers.

We wanted to port thermodynamics into OpenModelica - a prerequisite for chemical engineers. We have successfully demonstrated this possibility.

> Many of our models simulate in OM
>
> > Include control systems and electromechanical components in systems together with pure mechanical systems.

Proper sizing of the HVAC subsystem of EPR UK. Ability to prove the efficiency of the Modelica technology without having to buy licences

> Teaching applications, for example in the lecture course "System Simulation". We have tried to transfer our ThermalSeperation library from Dymola to OpenModelica with the help of PELAB (of course, we paid for the effort), but it didn't work.

Students use it for their thesis and we show tiny examples in lessons which can be reproduced by students. Challenges are frequent issues with the compiler (especially MBS) and the very slow editor.

Q7: Is your organization considering DFDs?

ANSWER CHOICES		RESPONSES	
No		76.19%	16
Yes (please specify for which purpose)	Responses	23.81%	5

1) to add new functionalities, which are critical for our organization 2) to expedite the closure of tickets which are critical for the reporter but not considered so critical by the consortium

Specific developments for power systems that would be difficult to push in the global pool of developments

Currently different possible work packages are in discussion

May be interested in the future, as a way to promote the use of OpenModelica. This will be an incentive for people to learn OpenModelica and become competent in it - if they know that they can get to do something at the end.

Possibly in the future

Q8: Is your organization considering MSAs?

ANSWER CHOICES		RESPONSES	
No		80.95%	17
Yes (please specify for which purpose)	Responses	19.05%	4

1) as before, to expedite the closure of tickets which are critical for the reporter but not considered so critical by the consortium 2) to get help when omc shows unpredictable behaviours 3) to get help when omc returns obscure error messages

Our long term goal is to use OpenModelica compiler in our industrial tools to assess the power system security. To make that, we need to have OM as a very industrial tool and to be able to get support in a few days when we have problems

Possibly in the future

This could be an option but we need a library which is running under OpenModelica.

Q9: Most appreciated improvements in 2007

Improved usability of OMEdit

The improved robustness of the multibody library. The availablity of DAE mode. The much improved usability and robustness of OMEdit The debugger is starting to get actually usable

State Machine graph editing

More robustness, stability and faster operation

Line numbers in OMNotebook

Did not notice major changes - I am not a heavy user, of course.

Improved coverage of the MSL and the selected additional libraries. Improvements in the performance of OpenModelica.

Speed. Debugging capabilities

Improvement of: - OpenModelica API - Stability - Performance - Open Modelica Testframework

Backend: Improved handling of nonlinear systems of equations around external functions.

Stability OMEdit

1) enhancements in the GUI 2) enhancements in stability 3) enhancements in the simulation speed for larger models

growing coverage of the MSL and other Libraries

Q10: Most wanted or missing features

For us we would have needed more focus, rather than trying to solve everything for every sort of use case.

The new Front-End Fast handling of models using Modelica.Media Support of replaceable classes and models

Improve source code generation for embedded targets, specially that state machines will be supported.

1) improving of efficiency of front-end and back-end processes, especially for models which involves complex libraries like Modelica.Media, or for very large models, like power transmissions grids. 2) management of replaceable models, 3) recursively exploring of instances of a model in order to change parameters, 4) to adopt a text-editor policy which allow to save a model or to switch to another model without checking of the current model, to make possible the saving of our work also if it is in an intermediate status (which can still contain errors) 5) improving of omc error messages, for example: - omc should returns the equations involved in found algebraic loops - omc should give indication about the redundant equations in case of structural singularity of the initialization system (like Dymola does) - the possibility to hide the errors which gives information to the developers but it is not relevant for the users (like scripting errors) - the warning messages should not be shown in the same colour (red) of the errors

Web-based interface for server deployment; database integration; I/O libraries.

Support for commercial (encrypted) Modelica libraries. Both full flattening and full simulation coverage of the MSL and the most important additional libraries.

Still problems to run large models with high speed

Q10: Most wanted or missing features - cont'd

Major Issues: (1) When deploying OMC we like to have a small OMC package with only the necessary functions like a nuget package for c# (2) Improvement of API - Start/Stop/Pause of simulation - Status of simulation progress - Unified return values from functions - Easy Access to models (GetParameters only return first level parameters) (3) Improvements of error handling in OMC for clearer error messages during translation (4) Improved stability and performance of OMC Minor Issues: (1) Working replaceable in OMEdit (2) Update mechanism for OMEdit in Windows

- Full support of stream variables (ticket 4441) - Full support of libraries using inner/outer and record dependencies (ticket 4442)

Bug free FMU Export in OMEdit, Replaceable support in OMEdit, Copy&Paste of models from sheet to sheet in OMEdit, Embedded Code Generator

It would be nice that OM is able to deal with state machines, variables aliasing at a much intense level and that's more a Modelica topic but that it would be possible to deal with vectors in Modelica

A better support of complex numbers. No need to specify what features in detail, since there exist several specific tickets on the trac about this.

Should be able to do sequential modular (SM) simulation. At present, we have only the equation oriented approach. The SM approach will help establish initial conditions for difficult problems. It will also help carry out startup and shutdown simulations.

The new front end ;-) , which will most probably solve some issues in coverage and improve the capabilities of OMEdit

Q10: Most wanted or missing features - cont'd

The lack of non-expanded arrays, i.e. Modelica arrays that remain arrays also in compiled code. This is not only missing feature of OM, but of all Modelica tools (we think).

Proper array/tensor support, i.e., do not expand them.

Better plotting facility Better handling of discrete/continuous equations

Compatibility to the Modelica language standard / covering all standard libraries.

Trust in the overall quality and usability.

faster OMEdit, reliable and performant FMU generation

Outlook

- 60% of the respondents already use OpenModelica for serious use
- 43% of the respondents mainly or exclusively use OpenModelica as Modelica tool
- 57% of the respondents uses OMEdit (→ no open source competitor!)

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- 43% of the respondents mainly or exclusively use OpenModelica as Modelica tool
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- Wide range of applications
  - Mechanics
    - Robotics
    - Hydraulic actuation
    - Motion controll
  - Energy
    - Power plants
    - Buildings/district simulation
    - Energy processes
    - Power systems and power grids

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  - Energy
    - Power plants
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- A few respondends interested in DFDs and MSAs

Outlook

- Positive feedback about increased robustness and speed
- Positive feedback about increased OMEdit stability and usability

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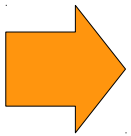
- Many wishes
  - Replaceable support
  - Increased coverage
  - Increased speed
  - Better support of Complex
  - Handle arrays as objects



New front-end!

Discussion

Thank you for your kind attention!