Report

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Final Report T5.16

1. Summary

The contributions in this task are centred on the Functional Mock-up Interface (FMI), where the main contributions are:

- The partners in this task contributed proposals for a sparse Jacobian extension to FMI. This extension will be part of the upcoming FMI 2.0 standard [2,E].
- Two prototype implementations [PU] of sparse Jacobian support were provided, one in OpenModelica and one in JModelica.org [1].
- An algorithm for derivative free optimization of Functional Mock-up Units (FMUs) was developed and made available (PU) in the JModelica.org OSS platform [3,C].
- Two Python packages, Assimulo and PyFMI, for simulation of FMUs was developed and made available (PU) in the JModelica.org OSS platform [4,7,B].
- FMU for Model-Exchange 1.0 export implementation [PU] made available in JModelica.org [7].
- A new XML schema for representation of flat Modelica models was developed [8,A]. The development was based on the FMI specification and on previous work in the area of XML and Modelica within the OpenModelica project.
- Two implementations [PU] of XML export compliant with the XML schema developed in this task in the JModelica.org [6] and OpenModelica platforms.
- Collocation algorithms for dynamic optimization of large-scale DAE systems made available in the JModelica.org platform [PU], [5,D]. The collocation algorithms are based on the XML schema developed in this task and the OSS tool CasADi, which supports import of such XML files.
- A task force for standardizing Modelica code in XML format was initiated based on, amongst others, results developed in this task. This work will carry on into the MODRIO project.
- Products released by Modelon AB [CO] were supported by FMI related-activities in this task: FMI Add-In for Excel, FMI Toolbox for MATLAB and OPTIMICA Studio.

2. Publications

2.1.1. Conference contributions

[1] Johan Åkesson, Willi Braun, Petter Lindholm, Bernhard Bachmann: ´Generation of Sparse Jacobians for the Function Mock-Up Interface 2.0´. In 9th International Modelica Conference, Munich, Germany, September 2012.

[2] Torsten Blochwitz, Martin Otter, Johan Åkesson, Martin Arnold, Christoph Clauss, Hilding Elmqvist, Markus Friedrich, Andreas Junghanns, Jakob Mauss, Dietmar Neumerkel, Hans Olsson, Antoine Viel: ´Functional Mockup Interface 2.0: The Standard for Tool independent Exchange of Simulation Models´. In 9th International Modelica Conference, Munich, Germany, September 2012.

[3] Christian Andersson, Sofia Gedda, Johan Åkesson, Stefan Diehl: ´Derivative-free Parameter Optimization of Functional Mock-up Units´. In 9th International Modelica Conference, Munich, Germany, September 2012.

[4] Christian Andersson, Johan Andreasson, Claus Führer, Johan Åkesson: ´A Workbench for Multibody Systems ODE and DAE Solvers´. In 2nd Joint International Conference on

Multibody System Dynamics, Stuttgart, Germany, May 2012.

[5] Fredrik Magnusson, Johan Åkesson: ´Collocation Methods for Optimization in a Modelica Environment´. In 9th International Modelica Conference, Munich, Germany, September 2012.

[6] Joel Andersson, Johan Åkesson, Francesco Casella and Moritz Diehl. Integration of CasADi and JModelica.org. In 8th international Modelica Conference, Dresden, Germany, March 2011.

[7] Christian Andersson, Johan Åkesson, Claus Führer and Magnus Gäfvert. Import and export of Functional Mock-up Units in JModelica.org. In 8th international Modelica Conference, Dresden, Germany, March 2011.

[8] Roberto Parrotto, Johan Åkesson, Francesco Casella. An XML representation of DAE systems obtained from continuous-time Modelica models. In Proceedings of the 3rd International Workshop on Equation-Based Object-Oriented Modeling Languages and Tools, (EOOLT´2010, Published by Linköping University Electronic Press, Oslo, Norway, Oct 3, 2010 www.ep.liu.se, In conjunction with MODELS2010, Oslo, Norway, Oct 3, 2010.

2.1.2. Master's thesis projects

[A] Roberto Parrotto (Nov, 2010). An XML representation of DAE systems obtained from continuous time Modelica models. Department of Automatic Control, Lund University.

[B] Christian Andersson (March, 2010). Assimulo A new Python based class for simulation of complex hybrid DAEs and its integration in JModelica.org. Department of Mathematics, Lund University.

[C] Sofia Gedda (August 2011). Calibration of Modelica models using derivative-free optimization. Department of Mathematics, Lund University.

[D] Fredrik Magnusson (January, 2011). Collocation methods in JModelica.org. Department of Automatic Control, Lund University.

[E] Petter Lindgren (Juli 2012). Ecient implementation of Jacobians using automatic differentiation. Department of Mathematics, Lund University.