1. Title of the WS/Tut/MS/SS/IS

Modeling complex models of physiology in Modelica and Physiolibrary

2. Organizers/Chairs

Tomáš Kulhánek, Jiří Kofránek

3. Abstract

The Physiolibrary (http://www.physiolibrary.org) is an open-source Modelica library usable for mathematical modeling of cardiovascular circulation, metabolic processes, nutrient distribution, thermoregulation, gases transport, electrolyte regulation, water distribution, hormonal regulation and pharmacological regulation mainly for the lumped-parameter approach. Modelica standard is supported by association composed from industrial as well as academical members and it is implemented by commercial as well as open-source tools. The Physiolibrary is currently used to model the most complex model of human physiology – PhysioModel (http://www.physiomodel.org/).

The tutorial will show acausal approach of modeling physiological system, which allows presenting complex models composed from different domains in comprehensible and maintainable form. Together with participants, models will be constructed of cardiovascular system, chemical reactions, body thermal transfer, osmotic phenomenon and integrative approach. Attendees should bring their own computers to participate in the hands-on sections of the tutorial.

4. List of Speakers (with their names, affiliations)

Tomáš Kulhánek, First Faculty of Medicine, Charles University in Prague, Czech Republic
Jiří Kofránek, First Faculty of Medicine, Charles University in Prague, Czech Republic
Marek Mateják, First Faculty of Medicine, Charles University in Prague, Czech Republic
Filip Ježek, Faculty of Electrical Engineering, Czech Technical University in Prague, Czech Republic

5. Brief Agenda

First part of tutorial will introduce acausal and object oriented Modelica language using an open-source tool OpenModelica (www.openmodelica.org) and a commercial tool Dymola. Attendees can install the open-source OpenModelica tool and Physiolibrary (www.physiolibrary.org) in advance before the tutorial.

The second part of the tutorial will consist of hands-on sections that will demonstrate building selected models of 1) cardiovascular system dynamics - using hydraulic domain. 2) common biochemical reactions - using chemical domain. 3) body thermal transfers with blood flow using thermal domain 4) liquid volume of the penetrating solution in intracellular space, extracellular space, interstitial space, blood plasma or cerebrospinal fluid using osmotic domain 5) integrative approach which connects these domains together.