FREE MULTITECHNICAL MODELING FOR MATLAB ACROSS THE INTERNET

H. Mann, M. Ševčenko

Computing and Information Centre ČVUT
Zikova 4, 166 35 Prague 6, {mann,sevcenko}@vc.cvut.cz

Computer-assisted simulation of a dynamic system requires solution of equations characterizing the individual system components and their mutual interaction. Formulation of the equations manually is time consuming and error prone. If Simulink is used for the simulation, even more manual work is required as a block diagram representing both sets of equations must be constructed in addition. Then only a computer can be used for the equation solution. Fortunately, computers can be exploited more efficiently, i.e. not only for solution of equations, but also for their automatic formulation.

DYNAST software, which is freely accessible across the Internet at http://virtual.cvut.cz, can do this. It is capable of formulating equations of multitechnical dynamical systems modeled by a multipole diagram. Such a diagram is composed from symbols of the system components interconnected by line segments representing bidirectional energy interactions between the components. Therefore, each such line segment is associated with two variables the product of which corresponds to power transferred between components via electrical or thermal conductors, fluid in pipes, shafts and other mechanical links, etc. (Recollect that each line segment interconnecting blocks in a block diagram represents just an unidirectional propagation of one mathematical variable.)

As the multipole diagram of a real system portrays directly the system configuration it can be set up in a kit-like fashion in the same way in which the system is assembled from its components. Such a modeling procedure is easy and straightforward as it is based on mere inspection of the modeled real systems. Using DYNAST software, you can set up multipole diagrams graphically on the screen of your computer in an intuitive way without learning any simulation language. Besides simulating nonlinear systems modeled by multipole diagrams, Dynast is also capable of linearizing the diagrams and providing their semisymbolic analysis in time and frequency domains.

The resulting semisymbolic transfer functions can be exported from DYNAST to Matlab installed on your computer across the Internet in the form of an M-file. Hybrid digital-analog systems can be co-simulated by DYNAST communicating with your Simulink across the Internet using the S-function. Therefore, you can exploit advantages of both Matlab and DYNAST environments to simplify control design considerably if you will proceed in the following steps and substeps:

Step 1. Modeling of the plant to be controlled and verification of the model using DYNAST:

- set up a nonlinear model for the plant to be controlled
- verify the plant model by its open-loop simulation
- linearize the model
- export the model transfer-function poles and zeros in an M-file

Step 2. Control design for the plant in the MATLAB environment:

- read in the M-file
- design either analog or digital control of the plant

Step 3. Control design verification in the case of

analog control design:

- augment the nonlinear plant model in DYNAST by the designed control loop(s)
- verify the control design by simulation of the closed-loop system using DYNAST

digital control design:

- set up the control structure in Simulink with a block representing the plant model in DYNAST
- verify the control design by co-simulation of the closed-loop system using Simulink with DYNAST