Implementation of COMSOL Multiphysics® in Simulink® S-Functions, Revisited

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Abstract

COMSOL Multiphysics® has standard facilities to export models to SimuLink®. Normally, the standard export works well if the solvers, available in SimuLink®, can handle the problem. However, if a model in COMSOL Multiphysics® needs special solvers, for example airflow or other non-linear problems, the standard export to SimuLink® is often not suitable, because the standard solvers of SimuLink® cannot handle such a problem efficiently. This can cause long simulation duration times and even leads to no solution at all.

Similar earlier work, based on FemLab, was already published in 2005. Due to the quite different MATLAB® interface in COMSOL Multiphysics® compared with FemLab, it is worthwhile to update this past work to the most recent COMSOL Multiphysics® version.

The paper presents a possible solution to this problem by implementing COMSOL Multiphysics® code in the discrete section of a SimuLink® S-Function (See Figure 1). The S-Function solves each time step the non-linear problem using the COMSOL Multiphysics® solver. After each time step the solution is exported. Furthermore, different boundary values can be applied at will.

The implementation of COMSOL Multiphysics® code in a S-Function is demonstrated by two case studies. Firstly, the former case study using FemLab, where the airflow temperature at the inlet of an office is controlled by an on/off controller in SimuLink®. Secondly another case study where an advanced controller of SimuLink® is integrated with a COMSOL Multiphysics® model.

It is concluded that COMSOL Multiphysics® models can also be exported to SimuLink® by writing an appropriate S-Function. The advantage of this approach is that the special solvers of COMSOL Multiphysics® can be used in the SimuLink® environment. This can lead to significant improvement of the simulation duration time. Furthermore it provides the possibility to use advanced controller facilities of SimuLink® with COMSOL Multiphysics® models.

Reference

A.W.M. van Schijndel, Implementation of FEMLAB in S-Functions, www.comcol.com

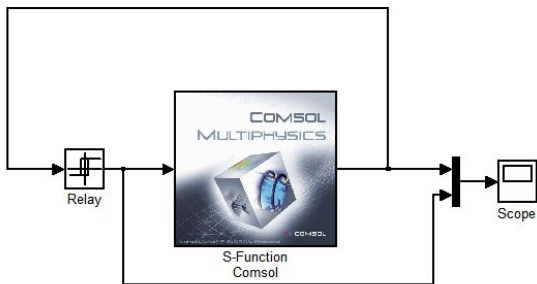# Figures used in the abstract

Figure 1: An example of implementing an comsol Matlab mfile into an SFunction of SimuLink