COMSOL Multiphysics® Automated Installation Verification Via LiveLink™ for MATLAB®

M. W. Crowell[1]

[1]Research Reactors Division, Oak Ridge National Laboratory, Oak Ridge, TN, USA

Abstract

For any computer code that is installed on more than one machine, some sort of installation verification is desirable for each new installation. Installation verification is the process of 'verifying' that a new code installation performs as the code developers intend. In many commercial applications this is not only desirable but is required, particularly when the results from a particular code installation can affect human safety or commerce. Because of this, many commercial codes perform a self-verification immediately after installation. This results in precise, consistent, and efficient installation verification for the end users which builds confidence in the code and its results. For codes such as COMSOL Multiphysics® which do not currently offer this functionality, each end user is left to perform their own installation verification when required, leading to imprecision, inconsistency, and inefficiency and ultimately less confidence in the code itself.

In this work we have developed an automated verification process for COMSOL installations utilizing the included library of pre-solved models and COMSOL® LiveLink™ for MATLAB® functionality. The MATLAB® scripts we developed perform the following tasks: identify models in the model library with included results that employ physics relevant to our applications (Figure 1), rerun the identified models on our local COMSOL installation, and compare the included and local results throughout the model domain and for all dependent variables (Figure 2). The time needed for this automated process is effectively limited to the time needed to run the models on the local installation, and the results are considerably more precise, consistent, and comprehensive than any manual verification effort could provide.

As a result, we are now able to verify COMSOL installations essentially as frequently as we wish with minimal personnel effort. In the past, using manual verification, we were severely limited in terms of the number of machines we could verify COMSOL installations on, and in how frequently we verified new COMSOL versions. This was a significant handicap in utilizing COMSOL for new analyses. Furthermore, we gained a better appreciation for the small variations in results that can be expected even among correct COMSOL installations depending on the type of model/physics and the convergence criteria employed.

Figures used in the abstract

Physics:	Fluid Flow				Heat Transfer				Mathematics				Struct. Mech.	
Models:	Fluid-Structure Interaction	Turbulent Flow, SST	Turbulent Flow, k-ε	Turbulent Flow, k-ω	Heat Transfer	Heat Transfer in Fluids	Heat Transfer in Solids	Heat Transfer in Thin Shells	Boundary ODEs and DAEs	Curvilinear Coordinates	Deformed Geometry	Global ODEs and DAEs	Shell	Solid Mechanics
oscillating fsi	X													
naca0012 airfoil		x												
ahmed body			x											
displacement ventilation				x		x								
heat sink surface radiation					x									
disk stack heat sink							x	x						
cohesive zone debonding									x					x
arterial wall mechanics										x				x
electrochemical polishing											x			
diffuse double layer												x		
bracket shell													x	x

Figure 1: Model/Desired Physics Matrix

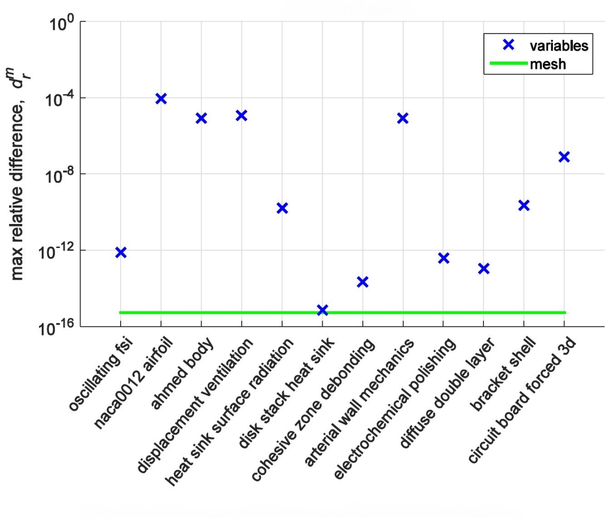

Figure 2: COMSOL provided vs. locally computed results