

Multi Electrical Machine Pre-Design tool with error handling and machine specific advanced graphical design aid features based on Modelica

Tomasz D. Michaski¹ Antoni Garcia Espinosa² Jordi-Roger Riba Ruiz³
 Luís Romeral Martínez⁴

^{2,3}Departament of Electrical Engineering, Universitat Politècnica de Catalunya, Spain,
 garciaae@ee.upc.edu, riba@ee.upc.edu

^{1,4}Departament of Electronic Engineering, Universitat Politècnica de Catalunya, Spain,
 tomasz.michalski@mcia.upc.edu, luis.romeral@mcia.upc.edu

This paper presents a design tool for Induction Machines, Permanent Magnet Synchronous Machines, Externally Excited Synchronous Machines and Switched Reluctance Machines. The sizing software is done in Modelica language. Is able to provide full dimensioning i.e.: cross and axial section measures (See Figure 1, right), and operation characteristics. The design is restricted by mechanical and electrical requirements (inputs) such as Rated Power, Rated Torque, Rated Speed, desired phase voltage, number of phases, pole pairs, angle of the V-shape (for IPM), etc..

Not all sets of inputs may be feasible. To help the designer reduce the number of iterations, the tool performs error handling during sizing (console messages) and after it via several tools (some are machine specific) and graphical aids. These tools are aimed to give clues about the possible design errors.

The tool is composed by two main layers: GUI and Sizing scripts (See Figure 1, left). GUI is made in MATLAB® GUIDE and does not involve any sizing operation only input and output handling. Sizing scripts are fully implemented in Modelica scripting allowing implementation in other libraries. Both are provided with help files and code explanation in order to re-use the tool and improve library's functionalities.

This pre-design tool is part of Modelica Library of Detailed Magnetic Effects in Rotating Machinery (MAGMOLIB) project managed by the German Aerospace Center (DLR) and developed by MCIA research center as part of the CLEANSKY partnership.

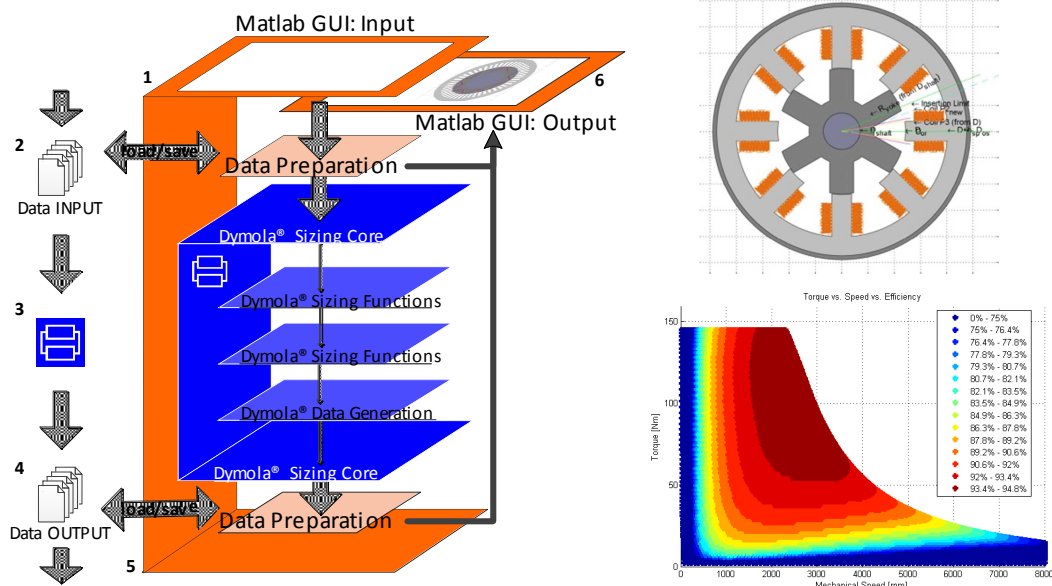


Figure 1. Left: Layer representation of the tool. Right-Top: Graphical representation of output cross section of SRM. Right-Bottom: Efficiency map (Torque vs. Speed) for IPM machine based on inductances and resistance values of the pre-designed Machine.