FLANDERS MAKE
MANUFACTURING INNOVATION NETWORK

The Strategic Research Centre for the Manufacturing Industry

Multi-physical modelling for optimal mechatronic system design

Thursday, 28 September 2017

09h30 ***Welcome***

10h00 **Building and using multi-physical models**
Bruno Depraetere, Project Manager, Flanders Make

Multi-physical models are essentially the model equivalent of mechatronic systems as they define and combine behaviour from multiple domains such as mechanics, electronics, pneumatics, software... By using these models, one single consistent model can be built and used for several system design tasks including component selection, control development..., which is in contrast to many current practices, where – without much coordination – multiple engineers use different models during different parts of the design process, leading to poorer designs and longer design processes. Now, for being able to start using multi-physical models and improve these activities, we need tools and methodologies to build and fine-tune such models based on experimentally acquired data and to effectively use them for system design and/or control development. All these aspects have been studied in the project and will be discussed during this workshop.

10h30 **Integrating CAD or FE models in multi-physical system-level models**
Martijn Vermaut & Jan Croes, Noise & Vibration Research Group, Flanders Make/KU Leuven

Many modelling frameworks are available but the most convenient ones, used by a wide variety of engineers, are system-level modelling environments such as simscape and AMEsim, which are based on lump parameter modelling. However, both during the design and lifetime of machines, there may be components that require a more detailed formulation making use of 3D CAD or FEM models. We will present solutions to automatically reduce and integrate these formulations into system-level framework models. The advantage of such nested approach combining FEM models and lump parameters is that the complexity of each system component can be modelled according to the simulation purpose, i.e. stress-related information is available when needed and approximation as a mass-spring combination is used whenever this is sufficient.

11h00 **Selected topics on advanced model building and usage**
Bert Lenaerts & Sam Weckx, Research Engineers, Flanders Make

We will present a few more advanced techniques and illustrate our presentation with some practical examples: techniques to estimate parameters from experimental data, techniques to select an optimal combination of sensors for a new design, techniques to develop an optimal controller for a new system, techniques to combine sets of library blocks into a full system model and use this for a system design...

11h30 **MultiPhys @ Siemens**
Cassio Faria, Senior Research Engineer, Siemens Industry Software

Siemens Industry Software (SISW) is applying model-based engineering techniques for a long time already and as such they have performed many model-based tests as well as analyses of various systems. Within the MultiPhys project, the focus was on the use of indirect estimation schedules to estimate forces in car suspension systems relying on less and cheaper sensors combined with models, and on developing and experimentally validating models for low-g behaviour of electronic power steering systems, with the ultimate aim of improving control. All these activities strongly relied on model building, improving the models with experimental data and using them for analysis and control design.

12h00 ***Sandwich Lunch***