# Studies on Multi-Domain Modelling and Thermal Coupling of a Machine Tool

Bernhard Heinzl[1], Matthias Rößler[1], Niki Popper[2], Michael Landsiedl[2], Christoph Dorn[3], Stefan Brandstetter[3], Friedrich Bleicher[3], Alexandros-Athanassios Dimitriou[3], Felix Breitenecker[1]

[1]Institute for Analysis and Scientific Computing, Vienna University of Technology, Wiedner Hauptstraße 8-10, 1040 Vienna
[2]dwh Simulation Services, Neustiftgasse 57-59, 1070 Vienna
[3]Institute for Production Engineering and Laser Technology, Vienna University of Technology, Karlsplatz 13, 1040 Vienna

Energy optimization in production plants is at present a very current topic. In this context, the research project INFO [1] deals with a comprehensive simulation of production halls with all micro- and macrostructures, in order to be able to make qualified predictions about the efficiency of different energy saving measures. An important subrange of this research concerns modelling and simulation of machine tools, two parts of which will be presented in this paper.

The first part focuses on general multi-domain modelling of an actual machine tool (i.e. a lathe from the Institute for Production Engineering and Laser Technology from the Vienna University of Technology). An object-oriented modelling approach allows combining electrical, mechanical as well as thermal aspects in a structural manner. Combined top-down and bottom-up modelling techniques with gradually increasing level of detail identify the degree of modelling effort necessary or sufficient for certain applications and simulating certain scenarios. Future work plans to validate the simulation results against measurement data obtained from machine tests with the lathe.

The second part concentrates on the thermal coupling of the machine tool components with the environment. For that we selected a specific area of a machine tool, i.e. a linear guiding device with drive motor. In a first step the thermal behavior is studied and in a further step we consider the heat transfer and other effects on the environment. For this, the room around these tools is discretised in thermal compartments, which can also affect each other. The object-oriented modelling approach allows refining the discretisation easily, so that effects of a higher resolution can be studied too. Like in the first part, the simulation results will be validated against measurement data from the machine tool.

---

[1] http://www.projekt-info.org