Job-ID: 0006

Development of a digital twin for the mechanical system development of an E-Axis

Wrocław

Motivation:
The rapidly advancing development of electromobility is also increasing the demands on the subsystems in terms of efficiency, performance and appropriate NHV behavior. In order to be able to accompany this development accordingly, the use of simulation at system level is being increased. This is to be taken into account with the development of a digital twin using the example of an electrified E-axle. Mechanical simulation at system level requires a powerful simulation tool in order to take into account the abundance of necessary parameters on the one hand and to map detailed effects at component level and study their behavior on the other. This complex task generally requires a good understanding of both the system and the components. This is to be further developed here.

Objective:
The simulation software eSuite is to be used as part of the student work / internship / master's thesis. This offers the possibility to consider a digital twin for the mechanical system simulation from the system level to the component level. The focus of the work is on the creation of virtual e-axis model, parameterization, and simulation, including evaluation of the dynamic behavior. Special attention will be paid to the development and provision of boundary conditions from system to component level. A sensitivity study and variant calculations to be developed by the students round off the work.

Scope of work:
- Literature research on the state of the art regarding:
  - Modelling of electric drives with focus on the evaluation of rotor dynamics and influence of gearing
  - Boundary conditions and input variables for the subsystem
- Creation of the simulation model at system level with all necessary boundary conditions and interactions of the components for a rotor of an electrical machine and its intermeshing
- Carrying out initial simulations with validation of the generated boundary conditions to develop system understanding
- Carrying out a sensitivity analysis of selected parameters (e.g.: gear parameters, balance quality, geometry, etc.)
- Development of suitable evaluation variables for assessing the rotor dynamics and the NVH behavior of the drive system
- Definition and execution of variant calculations (e.g.: speed-torque characteristic of the drive, etc.)
- If necessary, extension of the simulation model to take into account further effects

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