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Automotive Division

System simulation for sensor development

Influence of manufacturing tolerances and operational conditions on sensor performance

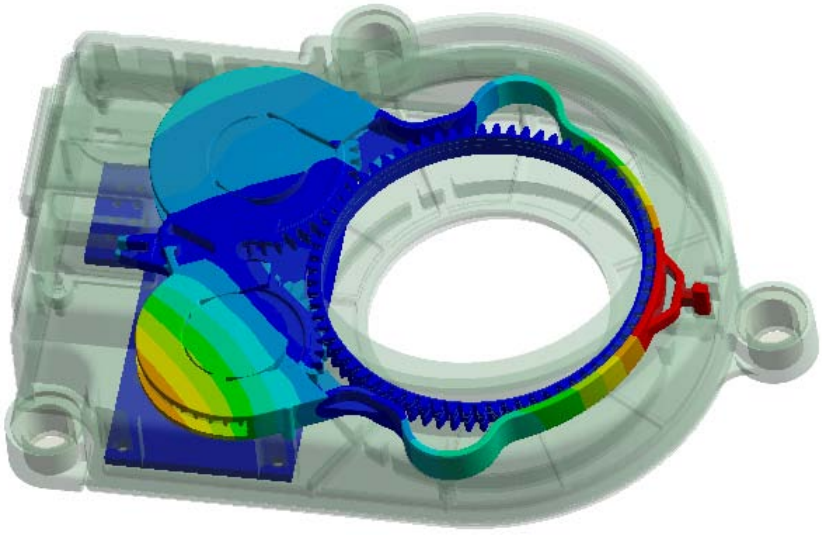

Fig. 1: Inner structure of a Steering Angle Sensor (above). Setup and 3D field simulation of thermically induced deformation (below).

Task

The Bourns Automotive Division has played a leading role in the design, development and manufacture of potentiometric sensors since 1949. New applications such as advanced driving assistance systems (ADAS) lead to increasing demands for sensor resolution and robustness under various operating conditions.

Simulation is already state of the art at Bourns for the investigation of sensor components. Yet so far the modeling of system behavior across various physical components, also in interaction with software, is not feasible using 3D field simulation due to computing performance limitations.

In order to meet requirements for development, sensor characteristics, manufacturability and costs, Bourns approach is to use system simulation based on the combination of reduced order models derived from field simulations and behavior models.

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Solution

The existing know-how from several 3D field simulations is reused – by means of several approaches the models are condensed and reduced order models (ROM) are derived. ROMs map component behavior very accurately across a wide range of applications at very low simulation times. In ANSYS Simplorer, the system model is set up: ROMs derived for mechanical and electromagnetic components are combined with the source code of the multi-turn-software for signal postprocessing. The so derived model very accurately depicts the behavior of the Steering Angle Sensor, governed by its components and their interactions among each other.

In addition to the sensor characteristics under ideal operating conditions, the influence of thermal loads and manufacturing tolerances on linearity, resolution and other performance measures can be explored.

Customer Benefit

System simulation accelerates the purposeful development of complex sensor systems consisting of various interacting components. Even with competing optimization goals and design restrictions it is possible to identify ideal sensor configurations through parameter variation. With the established workflow it is possible to determine the relevance of influencing quantities and to quantify resulting measurement deviations. The virtual prototype of the investigated sensor delivers insights into correlations which were not measurable before and hence help Bourns to investigate and validate innovative sensor designs in less development time.

By using system level simulation in the virtual product development of sensors, Bourns is able to fully meet increasing design demands arising from new applications like ADAS.

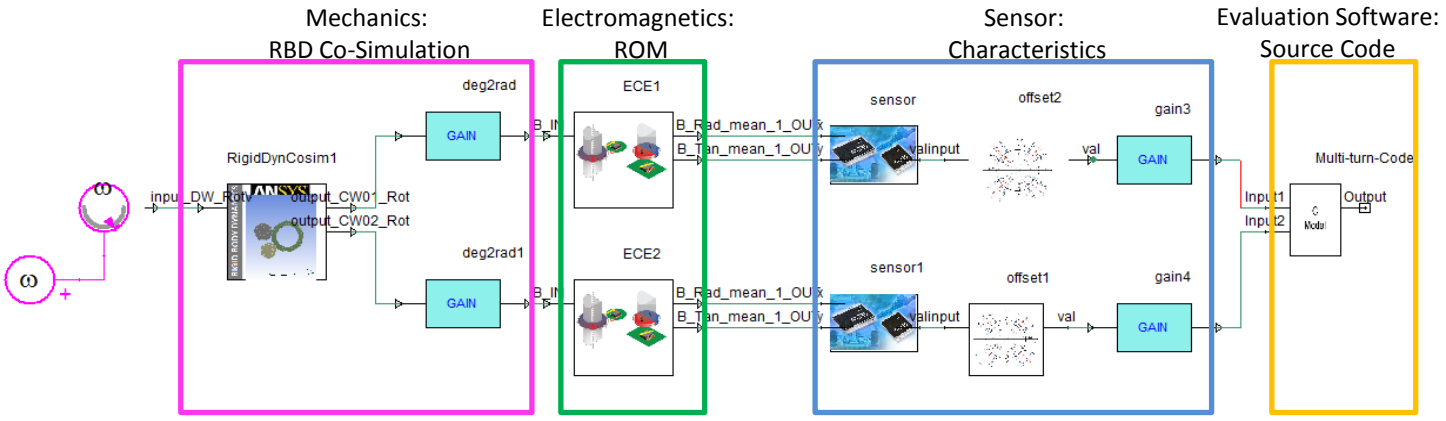

Fig. 2: Simulation of a Steering Angle Sensor consisting of mechanical and electromagnetic components in interaction with an Anisotropic Magnetoresistive Sensor and the multi-turn-code.

About CADFEM

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