

Project Note

Model-based design for pressure sensors

Precise high-vacuum pressure sensors are complex systems. To improve these types of sensors, Zühlke modelled and simulated their behaviour using MATLAB & Simulink. The firmware code was created from an iteratively optimized model.

Task

The customer was from the vacuum equipment industry and provided us with the hardware, which was based on a classic 8-bit microcontroller. Zühlke's job was to develop an optimum firmware within a short period of time.

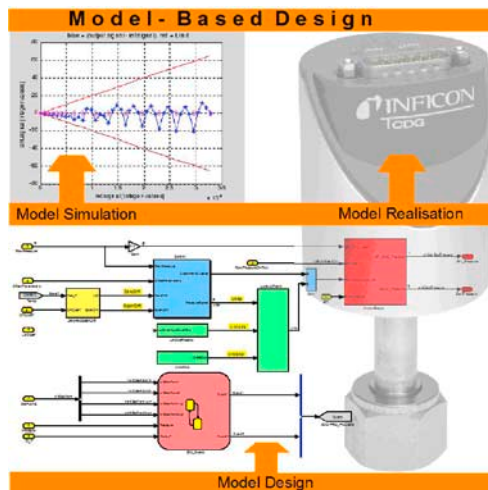
At the outset of the project, Zühlke formulated the tasks in simple terms and detected major uncertainty about the mode of operation of the measurement cell based on analogous signal analysis. The parameters relevant to quality were not yet known at this point and were to be determined as the project progressed. The object was to develop and implement the firmware. To better understand the sensor, the team had to model the system's behaviour first.

Implementation

To carry out the project, the experts from Zühlke selected a development process employing model-based design. Step one was to depict the system's key physical variables in a mathematical model using MATLAB & Simulink. This model was the basis

- for iteratively fine-tuning and calibrating the model using measurements and simulations;
- optimising sensor behaviour with the aid of the calibrated model;
- and generating the C-code for the firmware from the optimised model.

Thanks to this procedure, the team quickly succeeded in creating an optimum design for the quality of temperature compensation, signal linearity and signal resolution. In so doing, it met the high quality standards placed on the pressure sensor. The team also demonstrated that model-based design does not necessarily require an elaborate target hardware with an operating system.



Technical Data

- MATLAB
- Simulink
- Stateflow
- Fixed-Point Blockset
- Real-Time Workshop
- Embedded Coder

Customer benefits

- Zühlke's model-based approach has several advantages: A better understanding of the system meant the firmware could be adapted more efficiently. This efficiency, in turn, helped to mitigate the project risk. Fewer errors occurred during commissioning.
- The development time was markedly reduced overall.
- The graphical documentation of the numerical software section created transparency and is not linked to specific persons (i.e. more readily accessible).

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