Endress+Hauser
People for Process Automation

Multiphysics simulations of flow measurement sensors

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Abstract

At research and development (R&D) group of Endress+Hauser (E+H) Flowtec, computational fluid dynamic (CFD) simulations are utilized to simulation flow behavior in various flow measurement sensors. The flow meters of E+H are based on different physics principle, such as Coriolis, Ultrasonic and magnetic-inductive. In order to build a model of the complete behavior of the flow meters, not only the flow field but also the accurate modeling of the respective physics is important. For instance for the numerical modelling of ultrasonic (US) flow meter one needs to account to the coupled fluid dynamics and acoustics effects. The challenge in modelling multiphysics is mainly due to different time and length scales present in the problem. The different time and length scale make a simulation difficult to solve in an efficient manner. Furthermore, programs to simulate flow and other physics are usually not the same and one has to couple different programs.

In the present talk, an overview of multiphyiscs simulations for different flow principles will be presented. The focus, however, is on the coupled three-dimensional ultrasonic and flow simulations. In an US flow meter, the presence of high frequency or small wave length acoustic waves which makes the computations extremely memory demanding. Moreover, convective effects from the flow have to be taken into account in the acoustic solver by accounting additional terms in the perturbation equation for the acoustics. Due to high memory and computing time requirements, simulations have to be performed on a high performance computing (HPC) cluster. The role of HPC in R&D is also briefly addressed in the talk.

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