Special Feature: CAE and Simulation

Overview

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In today's automotive industry, CAE (computer-aided engineering) is an indispensable tool that supplements and alternates experimental evaluation for product performance. Due to developments in software and hardware, complicated computations for various problems can now be carried out with relative ease. However, to obtain reliable computational results, appropriate models of target phenomena under supposed conditions are required. The first article in this special issue reports a multiscale model for material performances. The second article reports a heat and mass transfer model in the turbulent flow field. Furthermore, CAE tools which can quickly evaluate the basic behavior or structure of a target system are required in the early stages of the design process of products. The third article reports a reduced dimension model for diesel combustion.

On the other hand, simulations are considered as computer-based approaches to solve unknown phenomena using as few models or assumptions as possible. In other words, these are the accurate numerical experiments for physical, chemical, or social phenomena. The fourth and fifth articles report on the microstructure of materials and the analysis of molecular scale dynamics at friction interfaces.

Both CAE and simulation are based on the so-called "forward problem" method of finding solutions, in which computational results are obtained by solving the fundamental equations for target problems under some initial and boundary conditions. However, in the engineering point of view, a more advanced approach based on the so-called "inverse problem" solution method may be required, in which new mechanisms or designs are created automatically to satisfy multiple conditions or requirements simultaneously. The final article reports about the topology optimization technique which is one of the most efficient methods to satisfy demand.