Japan J. Indust. Appl. Math. (2011) 28:1–2
DOI 10.1007/s13160-011-0036-y

EDITORIAL

Preface to the special issue on computer-aided engineering

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Published online: 23 February 2011

On the publication of this special issue

It is our great pleasure to launch this special issue on computer-aided engineering organized by our invited guest editor, Professor Ichiro Hagiwara of the Tokyo Institute of Technology. Computer-aided engineering is one of the typical areas where mathematics can be applied in a variety of ways, and indeed, this special issue covers a wide range of engineering fields from micro topics, such as hydrogen dispersion, semi-solid metals, and molecular dynamics, to broader topics, such as mechanical parts including transmissions, brakes and rotors, and bullet train behaviors in earthquakes. We appreciate Professor Hagiwara's great efforts in editing the special issue. We hope this collection of topics indicates possible future directions for industrial mathematics.

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Third stage of computer-aided engineering

Computer-aided engineering was born about 50 years ago and is based on industrial mathematics as it relates to such weighted residual methods as the finite element method, the finite difference method, the boundary element method, and so on. In its nascent stage, between 1960 and 1975, it was originally applied to mechanical engineering, architecture, and civil engineering. Expanding in the years from 1976 to 1990, computer-aided engineering contributed largely to shorter development periods of products by using virtual design, virtual manufacturing, and virtual experiments in tandem with the rapid growth of computers' capacity and memory, as well as the availability of efficient software systems.

One can say that we are now in the third stage of computer-aided engineering, which began in 1991. In recent years, its application has deepened and widened considerably. Computer-aided engineering has already been applied to material design, biotechnology, nanotechnology, and beyond, to the challenging study of "mind and brain." We expect to contribute further to society with many more developments. For this special issue we succeeded in collecting stimulating articles about this third stage. I express our gratitude to all who submitted their valuable, original work.

Ichiro Hagiwara
Guest Editor of the Special Issue on Computer-Aided Engineering