Column

MEMS Design and Analysis Support System Development (MemsONE) Project

Hidetoshi Kotera, Professor, Department of Mechanical Engineering, Graduate School of Engineering, Kyoto University

Steps in manufacturing include planning, functional design, basic design, trial production, functional testing, design for mass-production, and trial mass production. For manufacturing in the 21st century, computer-aided engineering (CAE) can be effective in each step of manufacturing to reduce the amount of trial production and to perform functional evaluations in advance for more suitably examining structures, principles, mechanisms, and materials.

Used, in many fields, CAE enables the researcher to virtually manufacture prototypes on a computer and to perform experiments to comprehend functions and phenomena of the object to be created. In MEMS R&D, the structure of the object is very small, making it difficult to grasp phenomena of the object through detailed measurements. Further, testing prototypes requires as much time and expense as normal equipment development. In this sense, CAE can be an effective tool.

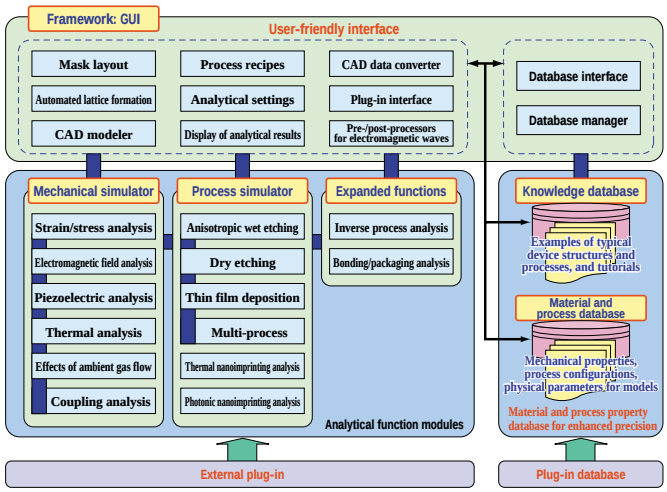
There are four fields within CAE, (1) computer-aided design (CAD), (2) computer-aided analysis (CAA), (3) computer-aided testing (CAT), and (4) computer-aided machining or manufacturing (CAM). CAD and CAA are the most important functions in research and development. Most researchers and engineers in MEMS R&D employ one of many general-purpose or proprietary CAE systems. Unfortunately, commercial CAE systems are terribly expensive and are prohibitive to beginners because of their extensive functions. The design and development of any equipment requires knowledge and experience in the materials, mechanisms, and structural processes involved. Even if one is versed in the usage of CAE systems, it is difficult to determine which materials to select and which mechanisms to use, as well as how to evaluate a device that has been manufactured virtually on a computer. Hence, a support environment is vital when using this system. In the case of MEMS, the properties of the finished materials and structures differ according to the equipment and conditions involved in production. Therefore, even if the device can be virtually manufactured on a computer, much time is still required for specifying conditions for actually manufacturing the device.

With this background, the objective of the MemsONE Project is to provide a CAE system that is readily available and easy to use for engineers and researchers aspiring to develop MEMS devices.

In the spring of 2007, the MemsONE system will be released in Japan free of charge. In addition to a CAD system for designing MEMS devices and various CAA systems for understanding such phenomena as how a virtually developed device will function, the MemsONE system has a knowledge database containing contributions from many experts in MEMS and a database of materials used in MEMS. The system has been designed so that first-time users and engineers with relatively little experience can design MEMS devices with less anxiety. The material database includes sample measurements of material properties obtained by domestic MEMS foundries during trial manufacturing. Results obtained by the user when designing MEMS devices on the computer can be used for trial manufacturing at a foundry service. (Note: material properties can change due to various factors and cannot be guaranteed.) The MemsONE system also incorporates an emulation program for calculating possible mask shapes once the final formation is entered, as well as a mask layout editor and functions for simulating such processes as etching and thermal and photonic nanoimprinting.

The MemsONE Project for developing this system has been subsidized by NEDO, enabling specialists from about ten companies and fourteen universities to participate in the development between 2004 and 2006. We sincerely hope that you will follow the progress of the MemsONE Project and obtain the MemsONE system for your own use in the spring of 2007.

General Concept of MemsONE System



Research and Development Members and Implementation Structure