MEMS-ONE Pj

Databases for Supporting the MemsONE Project

Yoshiharu Suizu, Planning Director, MEMS System Development Center, The Micromachine Center

1. Significance of the MemsONE Databases

The objective of the MEMS Open Network Engineering System of Design Tools (MemsONE) is to provide software support for engineers and researchers in a wide variety of fields, facilitating access to information in the field of MEMS with the aim of furthering the promotion and growth of the MEMS industry in Japan. To this end, our goal is to provide a system that not only supports advanced MEMS R&D, but also provides newcomers to the field of MEMS and researchers and engineers having less experience in this field with ready access to material-related information and knowledge possessed by veteran MEMS researchers.

Fig. 1 shows a functional breakdown of the MemsONE system currently under development to achieve the goals described above. MemsONE is configured of three functional sections including a GUI section referred to as framework software (within the yellow border in Fig. 1), a simulator section for computer-aided studies on various structural designs and manufacturing processes (within the blue border in Fig. 1), and a database section providing support to novice users (within the red border in Fig. 1).

The database section has both a knowledge database and a material and process database and functions in the background to support first-time and novice users. Although possessing different content and designed for different uses, these two databases are packaged together.

Next, the database section will be described in detail.



Fig. 1 Breakdown of the MemsONE functions

2. Goals and Features of the Knowledge Database

One of the databases supporting the MemsONE project is the knowledge database (see **Fig. 2**). In order to aid newcomers to the MEMS field in MEMS design, the knowledge database stores a wealth of data (such as knowledge, expertise, and examples) possessed by some of the leading researchers at university and company research centers, providing a userfriendly database for first-time and novice users.

The data accumulated in the knowledge database is broadly divided into the four categories of devices, processes, material properties, and analyses. These categories are further divided into two levels of subcategories. The database allows users to freely search and reference the data and to add additional entries at any time.



Fig. 2 Structure of the MemsONE database

3. Goals and Features of the Material and Process Database

The other database supporting the MemsONE project is the material and process database (see **Fig. 2**). The material and process database systematically accumulates various experimental data (mechanical properties of thin film materials, process data, etc.) and all data required for the numerical analysis of various MEMS structural designs and manufacturing processes that have been developed by MEMS engineers and researchers, providing a database to aid first-time users and the like in MEMS design. Material data including such mechanical properties as the breaking strength, Young's modulus, Poisson's ratio, and residual stress of thin film materials and process data including various data on dry etching and wet etching (etching rate, etc.) have been either acquired or collected through collaborations with universities, research institutes, and foundries to construct a useful database for foundries.

Data accumulated on the mechanical properties of materials and process data provide important parameters that influence the precision of numerical analyses. Accordingly, we are placing an emphasis on acquiring precise data under a wide range of conditions. We are also listing measuring instruments and conditions with newly measured data and collected data as auxiliary data in order to complement fluctuations in measurement values found for thin film materials that are due to the measuring instruments, conditions, and the like. This auxiliary data will be provided as factors for determining usage.

4. Conclusion

As mentioned earlier, the objective for the knowledge database and material and process database is to construct user-friendly databases that can aid new users in the field. Consequently, data structure, usage specifications, and the expansion of accumulated data are issues of the databases that must be addressed. At present, the issues of data structure and usage specifications have been substantially resolved. To complete the system, we will next focus on the acquisition and accumulation of data.

After its completion, the MemsONE system is expected to see extensive use by novices in the field, who can take advantage of the system's core databases. Their participation should help expand the nation's base of MEMS engineers and stimulate the promotion and growth of the MEMS industry in Japan.