DATA MANAGEMENT SYSTEM FOR THE DESIGN AND CHARACTERIZATION DATA OF MICROMECHANICAL COMPONENTS IN HETEROGENEOUS MICROSYSTEMS

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The paper presents a Data Management System, which provides a solution to handle information within the design flow of micromechanical components. This tool concentrates all the relevant data from design to manufacturing of micromechanical components in just one application and helps in addition to reduce data redundancy.

Keywords: Data Base Management System; MEMS design; Micromechanical Components.

1. Introduction

From simulation with suitable simulation models to the manufacturing with different technologies of micromechanical components there are many data of different kind. These data can be structured and managed by the Data Management System (DMS)[1].

The fundamental scheme of the database is flexible and can be modified to match the user's needs. Using different forms and the retrieval component of the graphical interface the user can utilize and explore the database. Furthermore, it is possible to give graphical overviews of micromechanical components and the parts it consists of. The user also has the ability to link every record to another record. This makes it easy to reuse, for example, simulation models in further projects.

2. General Structure

The basis of the DMS is a database where the data is structured in a physical data scheme. The data model is based on the Entity-Relationship-Concept. New requirements can be applied to the structure easily by use of the design process method based on the phase model [2]. An application program with a graphical user interface is the connection between user and database. The application provides different forms for user-friendly data presentation and functions for data input respectively manipulation. These functions are based on the Structure Query Language SQL.

2.1. *Categories*

The center of the scheme is the micromechanical component respectively system and their behavior description and usage. Therefore, the design- and characterization data in the scheme is subdivided in different categories. These categories are denoted Project, Design, Technology, Manufacturing/Quality Assurance, Modeling and Simulation (See Figure 1). This gives the user the advantages of a classification similar to the design flow of micromechanical components.

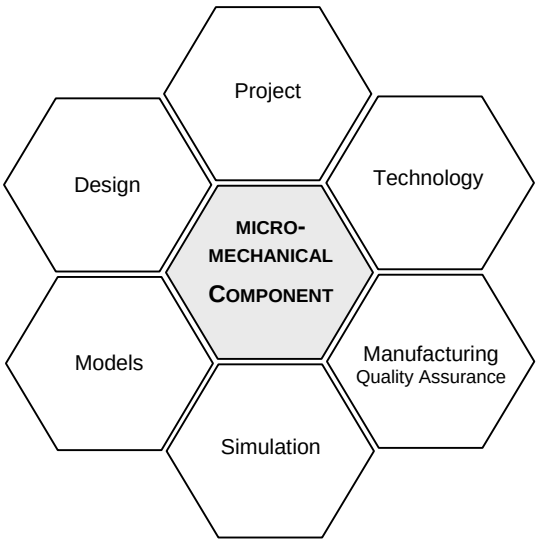

Fig. 1. Categories for a micromechanical component

Document Management

In all categories, documents of different kind and types were used. To handle these documents the DMS has a form to record any type of document files. The files will be stored binary in the database as so called Large Object Files. If the user activates a file, the DMS links it to the proper viewer or text-processing program. Through user generated connections the documents will be assigned to the corresponding category. It is also possible to link more than one document to a record in a category. On the other hand, a document can be linked to more than one record as well. Thereby the document name appears as a primary key for identification.

2.2. *Micromechanical Components*

The tree structure of the data model in the DMS is deduced on the design flow of MEMS. This structure gives information about the building and the disposition of a microsystem. A heterogeneous microsystem consists of components, which themselves can be parts of another's. A micromechanical component can be subdivided into a composite of other components and form elements (respectively construction elements). These are, for example, mirror plates, strips or special films in a micromechanical mirror array. Figure 2

shows the structure of a mirror array with the components and form elements it consists of. For a better understanding, “C” means component and “FE” form element.

Via the category Models a simulation model can be linked to the component. During the simulation, generated data can be stored as a record in the category simulation and in addition linked to the record in the category modeling. Further attributes for characterization of components and form elements can be assigned directly to the corresponding record as user-specific properties.

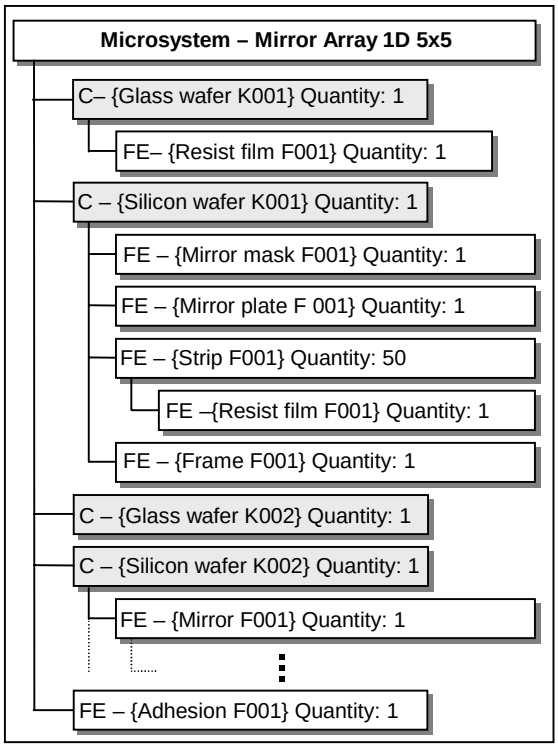

Fig. 2. Structure of mirror array 1D 5x5 [3]

2.3. *Reuse of Models*

Reuse of available components within the design flow is going to be more important due to the demand for shorter design cycles and reducing time to market. The interdisciplinary work assignment of the DMS as a Model-Repository has advantages for both designer and technologist likewise. With the feature of component retrieval, the DMS exposes as an important informational technical tool additionally.

The designer needs components and the dedicated form elements from the category Design to image the structure of a Microsystem. These components have to refer to the new Microsystem. Different micromechanical components can use thereby the same models of former components and form elements. This takes advantage of saving storage and a lower effort to write in the data. Any change in the design of the components has immediately effect to all Microsystems, which are linked to it.

Layouts and dedicated layout layers are structured similar to micromechanical components. It is possible to link predefined layout layers to different layouts. A layout again can be linked to a micromechanical component and the corresponding technology.

The Microsystem is the final product, which consists of different micromechanical components including models, stimuli, technology etc. The micromechanical component itself can be a part of another micromechanical component as well.

3. Conclusion

The Client-Server-Solution of the DMS is based on the relational database concept PostgreSQL running on a Linux PC. PostgreSQL is Open Source database management software. Reasons to use PostgreSQL are clear structuring and easy extension of the database structure. However, a data migration to another relational database system is possible.

The graphical user interface for the clients is based on the Script-Language Tcl/Tk to ensure the compatibility with different operating systems such as Windows 9x/NT or Unix. Fine adjustable user-rights guarantee the necessary data integrity within the database. The DMS is currently in use within the framework of the Sonderforschungsbereich SFB 379 at the Chemnitz University of Technology. The fields of research of the SFB 379 are micromechanical sensor- and actuator arrays.

The involved divisions within the SFB 379 have now the ability to bring together the data from different stages of the design flow of micromechanical components. In addition, it allows to accumulate acquired knowledge and to give an easier access to the concerned persons, who are involved.

This takes of course a lot of time for data maintenance at the beginning but the benefit through the common and more efficient use of the knowledgebase is more precious.

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