DATABASE SUPPORT FOR OPERATIONAL MEASUREMENT SYSTEMS

DATABÁZOVÁ PODPORA SYSTÉMŮ PROVOZNÍCH MĚŘENÍ

Abstract

This contribution shows concrete results achieved by solving the problems with storing and post processing data recorded by operational measurement systems. The contribution presents a special database system, developed at the Department of Control Systems and Instrumentation for storing large data files. Special wavelet transformations are used for data compression. A special focus is given to the search methods. The presented results have been obtained by collaboration with the Škoda Auto Company and during the solving of research project MSM272300009.

1. INTRODUCTION

Technical measurements are an integral part of a research and development of new technical devices. Now, they are also an integral part of production too, especially as a part of quality control systems. More new problems started up, like storing and following preservation of big data files. Many problems are also with processing of the measurement results, especially according to standards of ISO 9000 [Landryová 2004]. They include basic data about the measurement (structured data) and measurement outputs (huge data streams). Using database systems looks as a good idea, because of structured measurement data and their processing [Farana & Tůma 2002].

A basic question for arrangement of a concrete measurement system is how to build a storing system of measured data streams. Some measurement and analytic systems can cooperate with data exchange between different software tools, usually it is possible to use their object libraries. Other systems can work with previously saved data files only. Another problem is to develop a general (or properly parameterised) system, which can be used for any application, or to develop a specialised system optimised for a concrete occasion.

2. Basic system architectures

More concepts of database measurement system support were developed during solving research project MSM272300009. It was decided to develop specialised measurement systems, based on experiments and experiences with their use in operating conditions. An idea to develop a general system has been proved to be wrong, because of compound operating and a long response of the system. And it is not possible to use these systems for mass production systems [Babiuch 2004, Vítečková & Víteček 2002, Wagnerová 2002].

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The problem of data storing is not as easy to be solved, because of dependence on the used technical devices. During realisation of the measurement system for gearbox noise measurement data are stored to the database, because the used analyser system PULSE (Brüel & Kjær Co.) is an open structure and can cooperate with the other software systems. Anyhow the data streams are not longer (after compression) than the Memo data type, in a practical use it increases the data file too fast (about hundreds MB daily). Therefore we must include a special supervisory system for an administration and creating data files to the system. Nevertheless the used system MS-Access supports data files up to 1 GB, for practical application it is better if the file size does not exceed the capacity of CD-ROM disc. All system structure is shown in Figure 1.

![Diagram of system structure](image)

**Figure 1 – Component concurrence of the gearbox noise measurement system**

### 3. Special database applications

As listed below, the system of gearbox measurement is an example of storing all data to the database. It is not important problem to store all data to the database. More problems were in the collaboration between separate parts of the system. Especially the program data transfer from the database to spreadsheet took too long. We must agree to a compromise and transfer the data manually with the clipboard. The great attention has been given to the user interface, which has been adapted as user-friendly as possible for technical personnel. In accordance of prerequisites, it was verified, that the user with the only basic computer grammar cannot operate the database system.

A presented form and layout of objects come from the experience with using previous systems and proves to be effective. Significant faults were noted with operating this system. Problems occurred unexpectedly with inserting new gearbox data, which use standard MS-Access system, and it was not known for common users (special button in the navigation button’s area at the bottom of a window). The user interface has been changed according to his experience and a special button for inserting new data has been included.

A system for administration of data files is based on a data structure, which enables storing all needed information about tables, fields, indexes and relationships between tables, see [Farana & Tůma 2002]. A prepared system to clone new data file from the existing one was not used because of the risk of data file damage (respectively it’s data structure). This problem was registered a few times (during a half-year operation). The data file abuse was connected with the size of the data file, although it size was much less than the restriction.

The one of the most important problems is to search the measurement data. A special parametric search engine, developed as a part of the gearbox measurement database system, is shown in Figure 2. A search system allows combining three search parameters operated with the real data to avoid unsuccessful search during an incompatible parameter combination.
Figure 2 – Typical view of the parametric search engine

Figure 3 – An example of multidimensional wavelet transform

More different compression algorithms were also tested to save the database space, (RLE compression algorithm, Huffman code and LZW algorithm for lossless compression) especially when transferring data via Internet services. The result of their application are:

- RLE compression was the fastest algorithm in 90% of all data files and different measurement results, followed by the Huffman code.
- A compress ratio was maximal for LZW algorithm, followed by the Huffman code. The space reduction was 50% in the average.

All these tested algorithms are lossless, to achieve higher compress ratio we need to orientate research towards the loss-making algorithms. We have got very good results with the use of the wavelet transform, especially with multidimensional version, see Figure 3.

4. CONCLUSIONS

This presented paper directs attention to the problems of saving data acquired from operation measurements and shows possible solutions with the help of concrete realised applications. The MS-Access database is used as an environment for developing them, which is now a common system supplied by all needed requirements. Some problems have appeared during using them, especially with the use of big data files. Developing a special system for administration of data files and following use of smaller data files have eliminated these problems and an application of wavelet transform makes the data files smaller and more flexible for use. A developed parametric search engine helps us to make the database systems more user-friendly.
3. References


