Information Technology in Practice– Exploiting Potentials

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Summary

It is widely regarded that the potential of information technology in structural engineering is far from fully exploited. Current research and development are mostly concerned with challenging and sophisticated issues, which may result in major advances in structural engineering practices in medium to long term. The urgent needs of practising engineers are often left aside. The paper presents easily achievable goals that would significantly enhance efficiencies for all participants in building process. These can be attained by using the ability of computers to store, share and process huge amounts of data. This data document human design decisions and processing results. The necessity to agree on widely accepted storage formats for this data is emphasised. Finally the paper discusses the usefulness of component-based software in structural engineering.

Keywords: Information Technology, Structural Engineering, Product Model, CAD, Component-based Software

1 Introduction

In recent years a significant effort has been made to rationalise working processes in structural engineering, which has led to deployment of software in various activities. The emerging new applications in structural engineering like management systems, knowledge-based systems, monitoring systems, etc. are examples of this type of software. In the traditional FEM software as well one can observe an effort to create highly intuitive applications that can be readily integrated with Office and CAD applications.

These developments are useful and enhance our capability to cope with the growing complexity of the civil infrastructure in modern society. Nevertheless, it is widely felt that dramatic benefits from IT are yet to come. Some engineers even regard the deployment of IT in structural engineering practice as cost-irrelevant. In contrast to some other industries, one can argue that the use of IT in structural engineering is not the decisive prerequisite to survival in the marketplace.

IT research in structural engineering largely focuses on challenging and sophisticated issues like expert systems, artificial intelligence, neural networks, etc. Practical application of this valuable research cannot be expected in the near future, whereas the urgent needs of practitioners are often not adequately addressed. In practice there is no need for computers to do engineering. The engineers would, however, welcome the support of computers to free them from dull tasks and allow them to concentrate on creative work like design, assessment, analysis, etc.

2 Unique information

The strength of computers is in their ability to store, share and process huge amount of data. Data documenting planned or existing structures can be adequately stored in a integrated computer database and managed by computer programs. In this manner they can be made accessible for participants in the building process. Furthermore, the compatibility among the documents that are furnished by various disciplines can be guaranteed.

The structural documentation consists of geometrical and semantic information. The semantic information encompasses characteristics of structures, structural elements and materials. For different disciplines semantic information can be very different. For instance, a slab opening for structural engineer is a service shaft for HVAC engineer. The geometrical representation is perhaps the only **unique representation** for all disciplines. It is free of semantics (e.g. material properties, physical properties, etc.) and can be furnished by means of a three-dimensional (3D) model. This 3D model is pivotal for all other applications. The semantics of different disciplines can be added furnishing different applications. CAD Software, Facility Management Systems as well as FEM Software can be based upon this model. A 3D model allows not only integration of building process, but it also supports the utilisation phase as well.

To exploit these potentials, the following issues have to be addressed in future:

- Computer presentation of 3D models has to be used throughout the building process. It would be ideal if all products would support the same binary computer format for 3D representation.
- Currently available CAD systems have insufficient support for 3D modelling. 3D modelling is a cumbersome and tedious task. With growing computer capabilities, it has to be transformed into an intuitive task simulating real building activities. For instance, the user would be able to design complex geometrical forms by means of Boolean operation on existing 3D elements.

A standardised native binary format is hardly an achievable goal. Nevertheless, CAD producers should try to agree on a common binary format, before Microsoft introduces its own.

3 Developments in Information Technology

The rapid development of IT and the flood of different concepts makes it difficult to identify developments of benefit to the structural engineer. In the author's opinion, component-based software can find rational deployment in structural engineering. A component is a piece of software with an interface, through which foreign software can use its functionality. This approach may reduce the costs of development of individual software in structural engineering. In this manner, for instance, a customised dimensioning program can be combined with a FEM Software.

Furthermore, given that there is an established, standardised binary format for 3D models, components for handling them may become available. In this manner individual software may be assembled from components. Examples of such component-based software would be CAD programs, cost management programs, management systems, etc.