CONFERENCE REPORT

Symposium on future trends in computerized structural analysis and synthesis

Washington, D.C., USA, 30 October–1 November 1978

This three-day Symposium, co-sponsored by George Washington University and NASA Langley Research Center, differed considerably in scope from previous US Symposia in Computerized Structural Analysis and Design held in 1974 and 1976 at GWU. As the title implies, the organizers tried to stress trends and directions in computational tools and methods while playing down specific applications. In this they were largely successful and the meeting gained in interest, prestige, and international flavour for the change. The 'synthesis' aspect was, however, a misnomer as designers traditionally shun meetings of this type; in fact, only a handful of papers touched upon this topic.

Close to 500 participants registered, well exceeding the expected attendance of 350. This unexpected but welcome interest appears to reflect various factors. First, the change in meeting orientation as noted above. Second, a recent resurgence of high-technology engineering applications, especially in the USA aerospace industry, which was depressed during much of the 1970s. Finally, a sudden realization that 'something is happening' in the field of computer technology that can drastically impact current practices.

Fifty contributed papers and 17 'research in progress' papers were presented. In addition, there were three keynote addresses and a three-hour panel session completed the technical schedule.

The following topic headings give an idea of the range of subjects covered: (1) Future directions of structural applications and potential of new computing systems, (2) Advances and trends in data management and engineering software development, (3) Advances in applied mathematics and symbolic computing, (4) Computer-aided instruction and interactive computer graphics, (5) Nonlinear analysis, (6) Dynamic analysis and transient response, (7) Structural synthesis, (8) Structural analysis and design systems, (9) Advanced structural applications, and (10) Supercomputers, numerical analysis and trends in software systems.

As an overall impression, the writer found the meeting well organized, stimulating, and worth attending. Lively discussions following many of the papers dealing with computer-oriented topics such as (1), (2), (4) and (10) certainly conveyed the sense of impending changes in the way people (and not only engineering analysts) interact with computers. Compared to this, the methods and applications side of the Symposium can be considered adequate but uneven, with some good papers unfortunately balanced by the usual quota of 'recycles'.

The three keynote addresses were captivating – a rarity by any measure. Niels Lincoln, the 'godfather' of the Control Data STAR-100 supercomputer, ably described the high-strung world of the super-hardware designer, full of excitement and frustrations. Professor Fenves' talk on future directions of structural engineering analysis was a thoughtful and balanced view of the real world of applications. David Loendorf's talk was a step-by-step examination of the historical interaction of computer equipment and structural analysis methods and capabilities.

This was the first structural analysis conference to recognize and devote ample time to an exceedingly important subject: the management of scientific data in general and engineering data in particular. Business computing had to deal with an 'information explosion' first in the late 1960s and early 1970s, and the centralized database concept evolved as an answer to that challenge. Related concepts are making headway in scientific computing, which nevertheless faces a *sui generis* environment with its own set of operational requirements. Among such special features may be cited: the existence of local and global data-bases (the latter may be unified or disjoint), distributed computing (e.g., pre- and post-processing on minicomputers, major computational phases on large mainframes), program networks for interdisciplinary problems, dominance of array data structures, applications to product design. These and related aspects were explored in papers by J. Swanson, R. E. Miller *et al.*, E. Schrem, P. Mason *et al.*, and the present writer.

The two usually neglected areas of computer-aided instruction and symbolic computing were briefly but well represented. The papers by Noor and Andersen, and Korncoff and Fenves dealt with sophisticated applications of symbolic manipulation packages to the automatic generation of structural operators, and most especially finite element stiffness matrices. The paper by Professor Wilson on CAL (computer analysis language program) is likely to have a significant impact on the teaching of structural engineering.

Of the papers dealing with computational models, methods and applications, the contributions of H. Armen, A. Peano *et al.*, E. Alarcón *et al.*, W. E. Haisler and D. R. Sanders, and K. J. Bathe and W. F. Hahn are particularly worth reading.

A panel session held on the afternoon of 31 October commenced with position statements from the five panelists: V. Bassili (University of Maryland), S. Fenves (Carnegie-Mellon University), N. Lincoln (Control Data Corp.), E. Schrem (ISD, University of Stuttgart) and J. Swanson (Swanson Associates). Much of the first hour of spirited debate was concerned with the future (or lack thereof) of supercomputers. In this regard there seems to be a growing feeling that such one-of-a-kind machines will be relegated to fairly esoteric applications such as weather prediction, while the more cost-effective mini- and midicomputers take up a growing share of everyday engineering applications. During the final hour, a more general set of questions was taken: program development methodologies, design of future programming languages, the role of universities in teaching and training of engineers, the adaptation of methods to fit new computing environments and vice versa.

It was evident that the great software crisis of 1965–75 has left scars on many individuals who have seen optimistically conceived programming systems grow totally out of control. It was frequently noted that no general-purpose finite element codes of import have appeared in recent years; the initial development cost and most especially the maintenance expenses are too huge to contemplate. These veterans view with alarm the rapid proliferation of computer hardware that now extends in a fairly continuous spectrum ranging from supercomputers to microprocessors.