Preface

Applications that incorporate significant amounts of numerical calculations now abound in information processing. What were once leading-edge problems in simulation and design have now become routine applications. Recent years have brought many developments in support for such computations using IBM systems. This issue of the *Systems Journal* is dedicated to highlighting these advances.

Numerically intensive computing applications rely on more than fast processors. They capitalize on the large amounts of virtual and extended memory available on large systems, along with high-speed channels and networks to get programs and data into and out of these systems. High-performance workstations provide a means of both effectively developing and testing code, as well as the vehicle for interactively displaying results in graphical form. The opening paper by Prairie and Weis describes an integration of these IBM systems and product offerings that support numerically intensive computing to form a Technical Computing Structure (TCS).

McComb and Schmidt in their paper describe ESSL, the high-performance subroutine library that supports the IBM 3090 and its Vector Facility. The IBM Parallel FORTRAN compiler also contributes significantly to simplifying the preparation of programs for execution on IBM 3090 systems with multiple processors and/or Vector Facilities. The paper by Toomey et al. describes language extensions and capabilities of this advanced software product.

The IBM 3090 uses a memory cache to match the high speed of the processor to that of the memory. The paper by So and Zecca describes the cache architecture and analyzes its effectiveness for numeric applications. By understanding these relationships, a programmer can make better use of the architecture's high-performance capabilities.

Still further improvements in performance can be gained by examining opportunities to reorder the computational sequence and utilize appropriate portions of the ESSL. Samukawa, in his paper on programming style, explores these possibilities using a linear algebra example.

Research into the coupling of commercially available processors to solve larger computational problems is examined in the paper by Clementi, Logan, and Saarinen. The authors discuss various means of loosely connecting processors along with key performance parameters to be considered relative to the granularity of the computational task.

The paper by Kamel, Kindelan, and Sguazzero describes an application for the IBM 3090 system with multiple processors and Vector Facilities. The seismic computations involve processing large amounts of data, with significant floating-point content and heavy use of arrays. This application utilized the Expanded Storage available on the IBM 3090 to provide good performance together with transparent memory management of very large problems.

Virtual memory can free numerically intensive computations from the traditional size limitations of main memory. The computations discussed in the paper by Sakaki, Samukawa, and Honjou make use of the full IBM 3090 storage hierarchy, including Expanded Storage, to handle vast amounts of intermediate data, thereby achieving a 4- to 10-fold improvement in turnaround time under MVS/XA™.

Another application is described in the paper by Angeleri et al., this one from the automotive industry. The code employed was operative on non-IBM supercomputers, as well as IBM 3090s, with and without employing vector and parallel processing. The systems approach taken involved use of the IBM 5080 Graphics System to provide high interactivity by using this subsystem to provide image manipulation.

The concluding paper in this issue provides a demonstration of the utility of the IBM PS/2® Model 80 to provide an interactive environment, dedicated to the user, with which problems destined for mainframe computation can be explored and sized.

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Editor