Preface

Throughout the nearly four decades of its existence, IBM's Federal Systems Company (FSC) has been a software, systems, and products company with significant underpinnings in advanced technology. Its mission has been primarily to furnish IBM's largest customer, the U.S. Government, with information management solutions in a wide variety of areas.

One major emphasis that dates back to FSC's earliest years as IBM's Military Products Division—and later as IBM's Federal Systems Division—has been on fast, embedded, and real-time-oriented computers for specialized purposes. Examples range from systems for U.S. military aircraft and submarines to reliable space systems, such as those used on the Saturn IV moon rocket and the Space Shuttle. A paper in the 25th anniversary issue (September 1981) of this journal by Olsen and Orrange summarizes many of FSC's earliest achievements in this area.

Much of what is regarded today as structured programming has its origins in FSC achievements such as the Real Time Computing Complex (RTCC) for NASA's Mission Control and the mission-critical software aboard the Space Shuttle. Another paper in the 25th anniversary issue, this one by James, documents some of the RTCC achievements.

Beginning in the early 1980s, the scope of FSC's efforts expanded dramatically. A wide range of ground-based problems began to emerge that could be addressed with standard commercial equipment but required FSC's expertise with real-time systems and algorithms, as well as its ability to manage large programming efforts. Examples include the ground control system for the constellation of Global Positioning System (GPS) satellites and the air traffic control systems for the Federal Aviation Administration (FAA).

The late 1980s saw a further expansion of the scope of its efforts, to the addressing of computationally intensive problems in the non-aerospace branches of the U.S. Government, such as its Treasury, Postal, and Justice departments; problems that complemented federal needs, such as those associated with computer-integrated manufacturing; and problems of concern to other governments for which variations of FSC's expertise could provide cost-effective solutions. This, coupled with the organizational flexibility to deal with worldwide customers, led to its designation as the Federal Systems Company.

The papers in this issue provide a sampling of recent FSC efforts. The first two papers in the issue pertain to new classes of algorithms for basic but widespread functions. The paper by Bradford describes algorithms that extend the use of Fourier methods for solving the Poisson equation. The paper by Gozzo describes recursive least-squares algorithms that promise performance improvements in the reception of digital signals over channels with intersymbol interference and white Gaussian noise. Both classes of algorithms were developed while the authors were receiving their Ph.D. degrees under the IBM Resident Fellowship Program and reflect needs the authors had observed prior to their participation in the program.

The papers by Pritt, by Stiles and Glickstein, and by Arbabi et al. pertain to methods developed to address a specific class of applications. Pritt describes an algorithm for aligning two or more images to "match" at certain points. This is a typical step in the processing of images from earth-observing satellites. With the anticipated flood of data from such satellites in the future, this approach is expected to become increasingly important. Stiles and Glickstein describe another algorithm of this sort. In their case, the problem is the "optimal" routing of a vehicle from one point to another in multidimensional space, where the definition of "optimality" can vary dramatically from one application to another, and where additional constraints such as time, fuel, ruggedness of terrain, and various man-made features all conspire to complicate the problem. Uses of this approach range from routing military aircraft in combat situations, through unmanned "autonomous" vehicle navigation, to directing fleets of vehicles under changing traffic and pickup points.

The paper by Arbabi et al. addresses the transliteration of Arabic names into non-Arabic languages. It is an example of the emerging multinational aspects of FSC's customers' needs and the use of "artificial intelligence" methods.

The final two papers, by Rudd et al. and Johnson et al., pertain to efforts closer to achieving a complete customer solution. The paper by Rudd et al. describes part of a 25-year involvement by FSC in using satellite data to detect and track ballistic missile launches. The increasing amount and resolution of data from such satellites, coupled with increased demands for more timely and detailed results, have forced continuing efforts to understand launch and tracking phenomena, and the algorithms needed to process tracking data.

The paper by Johnson et al. reflects a similar long-term involvement by FSC. It describes efforts to scramble and unscramble data in cost-efficient ways while still maintaining a high degree of confidentiality in the data being transferred. Questions dealing with code strength, interoperability, and exportability to non-U.S. customers are all critical here and are reflected in a new approach.

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Guest Editor