Introduction

FORTH: A FIFTH GENERATION COMPUTER CONTENDER

In recognition of Forth's promise as a fifth generation technology, the 1986 Rochester Forth Conference had a theme of real-time artificial intelligence, applications and implementations. This sixth Conference was held at the University of Rochester and was sponsored by the Institute for Applied Forth Research, Inc. in cooperation with the Laboratory for Laser Energetics of the College of Engineering and Applied Science at the University and the IEEE Computer Society. The Conference was also supported by the Instrumentation and Controls Division of the Oak Ridge National Laboratory, Eastman Kodak Company and Videk, a Division of Eastman Technology. The Conference presentations included those of the invited lecturers, as well as papers on the full range of Forth technology, applications and implementations.

What makes Forth a candidate for AI applications? Perhaps foremost is its similarity to LISP where the equivalent of programs and data are represented by, and interpreted through, linked lists. However, unlike LISP, Forth was designed for the process control environment which required a minimum of resource usage and maximum execution speed. As a result, Forth is appearing as an alternative to LISP in implementing Very High Level Languages, such as OPS5 and Prolog. In addition, the recent realization of several Forth processors at both the chip and board level, some with an average execution of 10 million Forth operations/second, give additional incentive to explore Forth for fifth generation computer applications.

In particular, this year's invited lecturers addressed the application and implementation of two different Forth-based expert systems, and the possible use of object-oriented programming in AI:

REAL-OPS—A Real-Time Engineering Applications Language for Writing Expert Systems, Dr. William Dress, Oak Ridge National Laboratory.

Dr. Dress is with the development staff of the Instrumentation and Controls Division of the Oak Ridge National Laboratory. He works in sensor development and has been applying Forth technology to provide high-performance, high level languages for advanced computing applications. His paper discusses how Forth was used to implement the OPS5 programming language, integrating the two into a multitasking applications language for real-world control problems.

Development of a Threaded Object-Oriented Language, Mr. Charles Duff, Whitewater Group.

Mr. Duff is well known to the Forth and Apple Macintosh communities as the author of the Macintosh Smalltalk-like environment, Neon. He has continued his interest in object-oriented programming with the development of Actor for the IBM Personal Computer. His paper discusses the details of Actor and its possible consequences to both Forth and AI programming.

The Application of Artificial Intelligence Technology to Process Control, Captain Steven LeClair, Wright Patterson Air Force Base.

Captain LeClair is the technical director of Manufacturing Research in the Materials Laboratory. He is currently using Park's Expert-5 to control a process for making composite matrix materials. His paper describes sensor fusion, or the need to collect and understand aggregate data from multiple sources.

Toward the Development of a Real-Time Expert System, Mr. Jack Park.

Mr. Park is well known to the Forth community, having written the widely distributed Expert 2 package. He continues to work on real-time applied AI problems including weather prediction and heuristic discovery systems. His paper covers the evolution of Expert-2, Expert-4 and his concurrent Expert-5 which uses a pair of Motorola 68000 co-processors and an IBM PC.

Additional AI-related papers can be found by Basile, Bender, and Carr. Application papers include two different authoring systems, one by Abbot and the other by Louis, and a Forth Analog Computer Simulator modeled on Korn's Differential Analyzer REplacement (DARE) by Lordi. An entire section of space-based presentations was made with papers by Harris (JPL), Paloski (Technology, Inc.), Rash (NASA Goddard Space Flight Center) and Wood (McDonnell Douglas). Notably, all four of these authors' material is real-time AI related, and the first two involve Forth implementations of Prolog.

Several papers look at other languages implemented in Forth. Dixon's abstract mentions a C compiler in Forth, and two papers, one by Click and Snow, and the other by Duff, deal with object-oriented programming. Lecky describes a programming language for array processors and Mullen presents a language for non-linear optimization programming. Urieli suggests syntax improvements to Forth as used in REPTIL, which is implemented in Buege's RTL dialect of Forth.

The improvement of Forth programming tools is examined in several papers. Dixon applies the techniques of categorical grammers to Forth for improved syntax checking. Rather and Smith, in separate papers, look at documentation issues. Braams examines a powerful Forth programming environment and Joosten discusses a metacompiler running in that environment. Duncan also looks at possible improvements to metacompilation, while Almy and Rose separately discuss the speed improvments brought about by Forth compilers. Last year's interest in Forth machines continued this year with Koopman and Haydon's description of their processor, the MVP Microcoded CPU/16. Matheus' abstract mentions an AI benchmark running on the Novix Betaboard.

As this Conference Proceedings has shown, Forth is beginning to fill niches in traditional computer science. Will it continue to grow in these and other areas? Come to next year's Conference and find out.

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