

"Exploiting Data Parallelism in Irregular Programs"

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The parallel programming community has a lot of experience in exploiting data parallelism in regular programs that deal with structured data such as arrays and matrices. However, most client-side applications deal with unstructured data represented using pointer-based data structures such as trees and graphs. In her Turing award lecture, Fran Allen raised an important question about such programs: do irregular programs have data parallelism, and if so, how do we exploit it on multicore processors?

In this talk, we argue using concrete examples that irregular programs have a generalized kind of data parallelism that arises from the use of iterative algorithms that manipulate worklists of various sorts. We then describe the approach taken in the Galois project to exploit this data-parallelism. There are three main aspects to the Galois system: (1) a small number of syntactic constructs for packaging optimistic parallelism as iteration over ordered and unordered sets, (2) assertions about methods in class libraries, and (3) a runtime scheme for detecting and recovering from potentially unsafe accesses to shared memory made by an optimistic computation. We present experimental results that demonstrate that the Galois approach is practical, and discuss ongoing work on this system.

Biography:

Keshav Pingali is a professor in the Computer Science department at the University of Texas, Austin, where he holds the W.A."Tex" Moncrief Chair of Grid and Distributed Computing. He received the B.Tech. degree in Electrical Engineering from IIT, Kanpur, India in 1978, and the S.M. E.E., and Sc.D. degrees from MIT in 1986. He was on the faculty of the Department of Computer Science at Cornell University from 1986 to 2006, where he held the India Chair of Computer Science.

Pingali's research has focused on programming languages and compiler technology for program understanding, restructuring, and optimization. His group is known for its contributions to memory-hierarchy optimization; some of these have been patented. Algorithms and tools developed by his projects are used in many commercial products such as Intel's IA-64 compiler, SGI's MIPSPro compiler, and HP's PA-RISC compiler. In his current research, he is investigating optimistic parallelization techniques for multicore processors, and language-based fault tolerance.

Among other awards, Pingali has won the President's Gold Medal at I.I.T. Kanpur (1978), IBM Faculty Development Award (1986-88), NSF Presidential Young Investigator Award (1989-94), Ip-Lee Teaching Award of the College of Engineering at Cornell (1997), and the Russell teaching award of the College of Arts and Sciences at Cornell (1998). In 2000, he was a visiting professor at I.I.T., Kanpur where he held the Rama Rao Chaired Professorship.