Title: AlphaZ and the Polyhedral Equational Model

Presenter:

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Summary:

The polyhedral model is now established as a powerful, "domain-specific" model for program representation, analysis, and transformation. It is limited to a small domain (commonly called affine-control loops) for which it provides a very powerful abstraction. This tutorial will present, in a hands-on manner two aspects of the model that are not very widely known. The first is the *equational* aspect of the polyhderal model, where high level equations are used to describe polyhderal computations, and the powerful static analyses that are enabled by this declarative view. The second is exposure to an open source, research tool, AlphaZ that is designed in a modular maner to be very highly extensible. Participants will have the opportunity to write simple program transformations themselves.

Target audience:

Researchers and students interested in any of the following: automatic loop parallelization, declarative/equational programming, program transformation, programming models for large scale parallelism, compiler infrastructures.

Outline:

This half day tutorial, will have three sessions with appropriate breaks. There will be an initial lecture (45 minutes), followed by a demo of the AlphaZ system + hands-on exercises (75 minutes), followed by a one hour wrap-up lecture. The following topics will be addressed:

- Foundations
- Polyhedral representation of imperfectly nested affine loops and data dependences
- Affine scheduling
- Concurrency and data locality optimization via hyperplane partitioning
- Integrated tiling and fusion
- Efficient code generation with the polyhedral model
- Optimization of functional programs
- Polyhedral tools and their usage

Special Requirements:

Participants should bring their own laptop. We will provide a linux boot flash drive with the AlphaZ system, ready for the participants to use right away.

Presenter Bio:

Sanjay Rajopadhye received the B.~Tech (honors) in Electrical Engineering from IIT Kharagpur (India) in 1980 and the Ph.D.~in Computer Science from the University of Utah in 1986. He is curently on the faculty of Colorado State University. He is one of the inventors of the polyhedral model. His Ph.D. dissertation addressed the problems of scheduling and localizing of Affine Recurrence Equations, and established their closure under linear transformations. He has also worked on variable-dependent (one-dimensional) scheduling, code generation and memory optimization. Much of this work was accompanied by widely distributed implementations: the open source library Polylib (http://icps.u-strasbg.fr/polylib) was developed by Doran Wilde as part of his MS thesis. The popular code generator CLooG (see http://www.cloog.org) has at its heart, the first prototype implementation, LoopGen (see http://www.irisa.fr/cosi/ALPHA/codegen) of the Quillere-Wilde-Rajopadhye algorithm. His recent work on parameterized and hierarchical tiled loop generation is also accompanied by open source implementations (see http://www.cs.colostate.edu/MMAlpha/tiling).