Electrical and Computer Engineering Seminar

Title: **A New Approach to Inferring Array Shapes in MATLAB**
Speaker: **Pramod G. Joisha**

Date: **January 20, 2003. (Next Monday.)**
Time: **4:00 - 5:00 pm**

Venue: **L324 (ECE Conference Room, Technological Institute)**

Abstract:

There has been a revival of interest in typeless array-based languages in recent years following the commercial success of a number of problem-solving and visualization environments such as MATLAB and IDL. By melding a lucid syntax with features like implicit typing and multidimensional data structures, these languages have proven to be invaluable tools for data analysis and visualization, and the rapid prototyping of new specifications.

However, the very same features that have contributed to the popularity of these languages - particularly implicit array shape typing and array shape polymorphism - have impeded their compilation, limiting execution scopes to interpretation. Static knowledge of an array's shape is vital to the generation of efficient code since it empowers optimizations such as the elimination of redundant shape checks, compile-time verification of shape correctness and the advance allocation of storage (preallocation).

In this talk, I shall present a new approach to array shape determination in implicitly typed array-based languages like MATLAB that is based on the abstract interpretation of a program using algebraic systems. The talk will also show how such systems can be implemented using off-the-shelf commercial symbolic analysis packages like Mathematica.

The chief contribution is that, unlike all current techniques that don't attempt further inferences from a statically unknown shape, our techniques gather highly useful inferences even when shapes are compile-time unknowns. Furthermore, while previous approaches for MATLAB limited arrays to matrices, our methods do not restrict dimensionalities. This makes possible, for the first time, multidimensional array shape inferences that can also be symbolic.

A working prototype has been completed as part of a full-fledged type inference engine for MATLAB called MAGICA. MAGICA is currently available for public download from The MAGICA Home Page at:

http://www.ece.northwestern.edu/cpdc/pjoisha/MAGICA.

If time permits, I shall also demonstrate MAGICA.