

**NORTH CAROLINA STATE UNIVERSITY
OPERATIONS RESEARCH****OR/ISE 601/801****Tues., Feb 13, 2008
401 Daniels Hall
11:30 – 12:30 pm****A Parallel Macro Partitioning Framework
for Mixed Integer Programming****Dr. Andrew Miller
Assistant Professor
Dept of Industrial and Systems Engineering
University of Wisconsin - Madison****Abstract**

Many problems that arise in supply chain design, logistics, military, health care delivery, and other applications can be modeled as mixed integer programming (MIP) problems. These problems can be very difficult to solve, and there has been increasing interest in using grid computing and massively parallel architectures to solve them. Most approaches to using parallel resources to solve MIP problems have focused on parallelizing the branch-and-bound framework. While the speedup this provides can be significant, it seems that there are likely to be limits to the scalability of this approach, and the future promises to provide many more resources for solving large MIP problems than we currently know how to use efficiently.

In this talk we discuss a new framework that use ideas from MIP heuristics such as LP-and-fix and RINS to search for feasible solutions simultaneously on many different processors on a high performance computing architecture. Our framework is designed to create work for dozens or even hundreds of processors very quickly, and to ensure that the work done on different processors does not significantly overlap. This is accomplished by using high-level partitioning strategies (i.e., not single variable branching) to divide the feasible region, and using an MIP solver to process each of the the partitions thus defined on its own solver. Our framework has also been designed to be able to exploit information from previous solution runs to re-solve a problem after minor changes are made to it, and this ability may prove to be crucial in using MIP to provide decision support for real-time optimization.

While still in developmental stages, computational evidence suggests that our framework (using entirely open-source code) is already competitive with CPLEX on a state-of-the-art supercomputing architecture using up to 32 processors. Moreover, our framework has the potential to use many more processors simultaneously, which does not appear to be true of current state-of-the-art parallel branch-and-bound codes.

Bio:

Andrew J. Miller received a B.S. in Mathematics from Furman University in 1994. Later that year he began his graduate work at Georgia Institute of Technology, where he graduated with a Ph.D. in Industrial Engineering in 1999. His thesis research focused on the derivation and use of strong mixed integer programming (MIP) formulations of production planning problems. From September 1999 to December 2001 Miller was a visiting research fellow at the Center for Operations Research and Econometrics in Louvain-la-Neuve, Belgium, where he continued to do fundamental research in the area of MIP and its application to problems in production planning. In January 2002, Miller joined the faculty of the University of Wisconsin-Madison, where he is currently an Assistant Professor of Industrial and Systems Engineering. At UW he has continued to investigate strong formulations for MIP problems in general and production planning model in particular. In addition, his research now encompasses theoretical areas such as stochastic integer programming and MIP decomposition methods, application areas ranging from supply chain design to health care delivery, and computational challenges such as how best to implement MIP problems via massively parallel or grid computing frameworks.

Refreshments will be served in 401 Daniels Hall at 11:00 a.m.