

Invited Speakers

SAT, QSAT and Beyond: State-of the Art and Their Relation with Planning

Enrico Giunchiglia, Università di Genova

In this talk, I will review the state of the art in propositional satisfiability (SAT), quantified Boolean formulas evaluation (QSAT), and in other related problems. I will present the basic ideas behind the SAT success

story, and discuss how these tools and ideas can be applied in planning and, in general, for modeling and solving symbolic reachability problems.

Integrated Production Planning, Batching, and Scheduling, to Compromise among Antagonistic Optimization Criteria

Claude LePape, ILOG SA

Manufacturing rough plans and detailed schedules must establish a compromise between antagonistic optimization criteria: meet as much as possible of the established and expected customer demand; deliver customer demands on time; reduce production costs (processing costs, resource usage costs, setup costs, cleaning costs); keep little value in inventories without risking starvation, and so on. Usual practice is often very unsatisfactory in this respect. For example, rough plans are often built by averaging setup times and costs, even when variations are significant; production batch sizes are determined by economic considerations, with no respect to the distribution of demand due dates; detailed schedules are built and maintained under fixed resource availability and production order to demand pegging assumptions. In many cases, globally suboptimal results are obtained because at some step in the process, an important optimization

criterion and associated constraints have been ignored.

The ILOG manufacturing planning and scheduling team is engaged in the development of new integrated planning, batching, and scheduling models, aimed at ensuring greater consistency between the planning, batching, and scheduling steps, and, as a result, at delivering better plans and schedules. This leads at each step to the consideration of optimization criteria that seldom appear in the classical literature. A publicly available test-bed based on a variety of problem classes is developed and used to evaluate the quality of a given combination of models, hence the interest of the work pursued. Globally, results show that progress is being made, but room for further improvement remains gigantic. We hope the availability of the test bed will attract other researchers to the study of the deep underlying optimization issues.

Model-based Programming of Robust Agile Systems

Brian C. Williams, Massachusetts Institute of Technology

Autonomous, self-repairing explorers, such as deep space probes, have successfully performed complex missions by employing model-based executives that continuously monitor mission goals, diagnose failures and plan repairs. These executives employ models encoded as probabilistic constraint automata, in order to observe and control the hidden states of the system. These executives have also been incorporated within model-based programming languages that facilitate the creation of a wide range of fault adaptive systems, including automobiles and naval ships.

Future explorers, such as autonomous air vehicles and walking robots, will require far greater agility, in order to robustly achieve their missions. For example, to avoid falling, a walking robot must quickly

detect a loss of balance, and replan its control trajectory appropriately. My talk presents recent advances in model-based programming and execution for agile systems. First, to reason about a system's dynamics, these executives employ probabilistic constraint automata that are extended to hybrid discrete or continuous constraints. Second, to robustly achieve missions, these executives employ planning methods that reason about continuous, as well as discrete, state changes, and employ compilation and model-predictive control methods in order to adapt on the fly. Finally, these executives employ estimation methods for hybrid PHA that detect subtle failures through active control. Model-based execution is demonstrated both on a team of cooperative air vehicles and a biped walking machine.