# Quantifier elimination applied in simulation and scheduling

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In a talk at the IMACS conference 1995, Albuquerque, I presented a method for the elimination of linear variables from a boolean system of parametric linear constraints, that provides also parametric sample solutions of the system. Applications included the simulation of industrial networks of components with piecewise linear behaviour and convex parametric optimization problems with linear constraints and linear or quadratic objective function.

The present talk concerns two extensions both of the elimination method and of the application areas. First, the method is extended to the elimination of quadratic variables, with applications to quadratic constraint solving e.g. in the simulation of hydraulic networks.

Second, the linear elimination method is extended to cover non-convex piecewise linear parametric optimization problems. These problems are given by a boolean combination of parametric linear constraints and a piecewise linear objective function $q$. Typically $q$ is obtained from linear functions by nested applications of max, min, addition and scalar multiplication. I show how to model fairly general scheduling problems with explicit time and ressource restrictions as instances of this type of elimination problem. By some test examples I will report on first successes and typical difficulties, and sketch strategies to attack these difficulties.

Most of the algorithms have been implemented in REDUCE in the REDLOG-package, due to A. Dolzmann and T. Sturm.