Pitfalls of Computing Enclosures of Overdetermined Interval Linear Systems

Jaroslav Horáček[1,2] and Milan Hladík[1,2]

[1] Charles University, Faculty of Mathematics and Physics, Department of Applied Mathematics, Malostranské nám. 25, 118 00, Prague, Czech Republic
horacek@kam.mff.cuni.cz, hladik@kam.mff.cuni.cz

[2] University of Economics, Faculty of Informatics and Statistics, nám. W. Churchilla 4, 13067, Prague, Czech Republic

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Real-life problems can be described by different means – difference and differential equations, linear and nonlinear systems etc. The description can be often transformed to another one using only linear equalities (or inequalities). That is why interval linear systems are still in the focus of researchers. There are plenty of methods for enclosing the solution set of square interval linear systems (systems in the form Ax=b, where A is a square matrix). That is the impact of some possibly good properties of square matrices. They can be diagonally dominant, positive definite, M-matrices and many more. And we know that our algoritms behave well in those cases. However we have some systems called overdetermined. Simply said, they consist of more equations than variables.

There are some known methods for solving them – Gaussian elimination, classical iterative methods, the Rohn method, the least squares, supersquare and subsquare methods or linear programming. Of course, in applications the matrices can often be of some very specific form. But if we consider random matrices, there are some cases when these methods can fail to compute any result. Here we would like to present a brief summary of existing methods for solving overdetermined linear systems and the problems we met when testing those methods on random matrices with specific properties. Our task was to achieve the best possible enclosures on solutions of interval linear systems with various radii of intervals. It is interesting to observe how some efficient methods fail when the radii of intervals change and, on the other hand, to see how some simple, one could say "stupid" methods rule. We do not want to criticize yet developed methods, we just want to point out that we must be careful when applying chosen methods to solve our desired problems. As always it holds that not every method is useful for every problem.