Exploiting structure in polynomial optimization for power and water networks

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Abstract

Some hard non-linear optimization problems can be solved quite efficiently because they exhibit sparsity (subsets of variables or terms appearing separately in the problem) or symmetry (repeated patterns in the problem). Often, these types of structure occur in network-based engineering problems, such as AC power flow problem in power networks and the valve setting problem in water networks. These are large non-convex quadratic optimization programs, but they consist of many small subproblems connected with sparse linking constraints. I will do a brief introduction into these problems, show how one can use sparsity and symmetry to obtain fast and strong bounds, and present some numerical results on realistic power and water networks.