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Multi-parametric disaggregation technique for global optimization of polynomial programming problems

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Abstract This paper discusses a power-based transformation technique that is especially useful when solving polynomial optimization problems, frequently occurring in science and engineering. The polynomial nonlinear problem is primarily transformed into a suitable reformulated problem containing new sets of discrete and continuous variables. By applying a term-wise disaggregation scheme combined with multi-parametric elements, an upper/lower bounding mixed-integer linear program can be derived for minimization/maximization problems. It can then be solved to global optimality through standard methods, with the original problem being approximated to a certain precision level, which can be as tight as desired. Furthermore, this technique can also be applied to signomial problems with rational exponents, after a few effortless algebraic transformations. Numerical examples taken from the literature are used to illustrate the effectiveness of the proposed approach.

Keywords Polynomial · Signomial · Optimization · Mixed-integer linear programming · Parameterization

1 Introduction

Real-world optimization problems across all branches of engineering, applied sciences and sciences in general, often require non-convex terms to be included in the models, either in the objective function or in the model constraints. These are responsible for a wide variety of local solutions, turning non-convex programming into one of the hardest fields of optimization, with many challenges in both practical and theoretical aspects. Rigorous global optimization

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