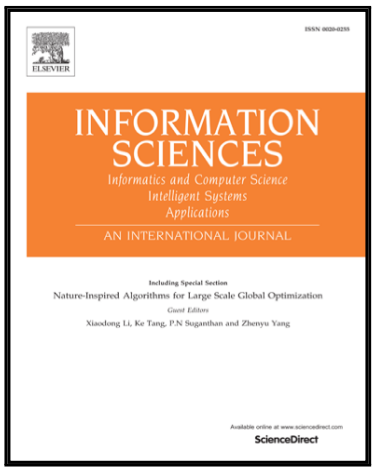

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A Radial Boundary Intersection aided Interior Point Method for Multi-objective Optimization

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Abstract

We propose a novel multi-objective optimization technique combining non-convex Radial Boundary Intersection based decomposition with an Interior Point method (which utilizes both line search and trust region steps) suitable for non-convex nonlinear optimization. Radial Boundary Intersection decomposes the multi-objective optimization problem into subproblems which are concerned with finding the solutions closest to a reference point along equally spaced lines emanating radially outwards from the latter point. The proposed approach is found to be able to generate good approximations of the Pareto front (including the periphery) by generating a sufficiently diverse set of Pareto optimal solutions. The proposed method is extensively tested on a large number of recent benchmark problems and real world problems and the performance is found to be favourable in comparison to those of some of the cutting-edge stochastic/evolutionary optimization algorithms that are commonly used to solve non-convex multi-objective optimization problems.

Keywords: Multiple objective optimization, Boundary intersection, Interior point method, Line search, Trust region

1. Introduction

Practical problems involving decision-making often consist of mutually conflicting objectives which prevent any possibility of simultaneously optimizing all the objectives to their best values. Mathematically, a Multi-objective Optimization Problem (MOP) can be expressed as

$$\min_{\mathbf{x}\in\Omega} \mathbf{F}(\mathbf{x}) = \begin{bmatrix} f_1(\mathbf{x}) \\ f_2(\mathbf{x}) \\ \vdots \\ f_m(\mathbf{x}) \end{bmatrix}, \quad m \geq 2, \tag{1}$$

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