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An iterative multi-objective particle swarm optimization-based control vector parameterization for state constrained chemical and biochemical engineering problems

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Highlights

1. A novel CVP approach with IMOPSO, named as CVP-IMOPSO, is first proposed.
2. A region reduction strategy is embedded into the proposed CVP-IMOPSO approach.
3. Results of benchmark problems reveal the effectiveness of the IMOPSO approach.
4. Results of three classical cases demonstrate the efficiency of CVP-IMOPSO approach.

ABSTRACT

Dynamic optimization of the state constrained chemical and biochemical engineering problems has always been the research hotspot due to the difficulties of handling constraints. In this paper, a novel approach, CVP-IMOPSO, is presented to tackle this kind of problems, where the original optimization problem is firstly converted into a multi-objective dynamic optimization problem based on a method of handling state constraint; and control vector parameterization (CVP) is then applied to transform the resulting infinite dimensional problem into a nonlinear programming (NLP) problem; finally, an efficient iterative multi-objective particle swarm optimization (IMOPSO), embedded with an region reduction strategy, is proposed to tackle this MOO problem. This strategy reduces the search space gradually during the iteration process so as to further promote the convergence rate and diversity of MOPSO. Three well-known classic optimization problems for chemical and biochemical engineering processes have been tested as illustration, and the detailed comparisons among IMOPSO, MOPSO and NSGA-II are carried out for seven benchmark problems. The research results not only show that the proposed IMOPSO is an

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