A Novel Hybrid Adaptive Collaborative Approach Based on Particle Swarm Optimization and Local Search for Dynamic Optimization Problems

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Abstract

This paper proposes a novel hybrid approach based on particle swarm optimization and local search, named PSOLS, for dynamic optimization problems. In the proposed approach, a swarm of particles with fuzzy social-only model is frequently applied to estimate the location of the peaks in the problem landscape. Upon convergence of the swarm to previously undetected positions in the search space, a local search agent (LSA) is created to exploit the respective region. Moreover, a density control mechanism is introduced to prevent too many LSAs crowding in the search space. Three adaptations to the basic approach are then proposed to manage the function evaluations in the way that are mostly allocated to the most promising areas of the search space. The first adapted algorithm, called HPSOLS, is aimed at improving PSOLS by stopping the local search in LSAs that are not contributing much to the search process. The second adapted, algorithm called CPSOLS, is a competitive algorithm which allocates extra function evaluations to the best performing LSA. The third adapted algorithm, called CHPSOLS, combines the fundamental ideas of HPSOLS and CPSOLS in a single algorithm. An extensive set of experiments is conducted on a variety of dynamic environments, generated by the moving peaks benchmark, to evaluate the performance of the proposed approach. Results are also compared with those of other state-of-the-art algorithms from the literature. The experimental results indicate the superiority of the proposed approach.

Keywords: *Dynamic Optimization Problems*, *Moving Peaks Benchmark*, *DOPs*, *MPB*, *Particle Swarm Optimizer*, *Naive Direct Search*.

1. Introduction

Optimization in dynamic environments has emerged as an important field of research during the last two decades, since many real-world optimization problems tend to change over time. The representative examples of real-world Dynamic Optimization Problems (DOPs) are portfolio