subproblems are expanded by additional constraints, describing F, to guarantee feasibility with respect to this subset in each iteration step. The algorithm is introduced and some numerical examples from Free Material Optimization are presented.

01271
Embedding a Competitive Ranking Method in the Artificial Fish Swarm Algorithm for Global Optimization

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Nonlinear programming problems are known to be difficult to solve, especially those that involve a multimodal objective function and/or non-convex and at the same time disjointed solution space. Heuristic methods that do not require derivative calculations have been used to solve this type of constrained problems. The most used constraint-handling technique has been the penalty method. This method converts the constrained optimization problem to a sequence of unconstrained problems by adding, to the objective function, terms that penalize constraint violation. The selection of the appropriate penalty parameter value is the main difficulty with this type of method. To address this issue, we use a global competitive ranking method. This method is embedded in a stochastic population based technique known as the artificial fish swarm (AFS) algorithm. The AFS search for better points is mainly based on four simulated movements: chasing, swarming, searching, and random. For each point, the movement that gives the best position is chosen. To assess the quality of each point in the population, the competitive ranking method is used to rank the points with respect to objective function and constraint violation independently. When points have equal constraint violations then the objective function values are used to define their relative fitness. The AFS algorithm also relies on a very simple and random local search to refine the search towards the global optimal solution in the solution space. A benchmarking set of global problems is used to assess this AFS algorithm performance.

01280
Comparative Study of Penalty Simulated Annealing Methods for Multi-local Programming

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In a multiglobal optimization problem we aim to find all the global solutions of a constrained nonlinear programming problem where the objective function is multimodal. This class of global optimization problems is very important and frequently encountered in engineering applications, such as, process synthesis, design and control in chemical engineering. The most common method for solving this type of problems uses a local search method to refine a set of approximations, which are obtained by comparing objective function values at points of a predefined mesh. This type of method can be very expensive numerically. On the other hand, the success of local search methods depends on the starting point being at the neighbourhood of a solution. Stochastic methods are appropriate alternatives to find global solutions, in which convergence to a global solution can be guaranteed, with probability one. This is the case of the simulated annealing (SA) method. To compute the multiple solutions, a function stretching technique that transforms the objective function at each step is herein combined with SA to

be able to force, step by step, convergence to each one of the required global solutions. The constraints of the problem are dealt with a penalty technique. This technique transforms the constrained problem into a sequence of unconstrained problems by penalizing the objective function when constraints are violated. Numerical experiments are shown with three penalty functions. This is a joint work with Edite M.G.P. Fernandes.

01282
The influence of control parameter costs in a dynamic epidemic model

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Dengue is a disease predominantly found in tropical and sub-tropical climates, mostly in urban and semi-urban areas. According to the World Health Organization, the incidence of dengue has drastically grown in recent decades and about two fifths of the world's population are now at risk. Humans are contaminated through mosquitoes, mainly by the aedes aegypt, but only the female mosquitoes acquire dengue from an infected human. People not only provide the mosquitoes with blood meals but also nutrients needed to reproduce through water-holding containers in and around the home. The dynamic model presents a set of nonlinear ordinary differential equations and an objective function in order to minimize government investment in fighting the disease. Total investment consist in costs to break the reproduction cycle of the mosquitoes, such as the application of insecticide, in the educational campaigns and also in costs related with human health issues. The goal of this paper is to use optimal control approach to evaluate the effectiveness of the controls. Tuning the parameters of associated costs, different results are reported. Depending on relative weight of the controls, numerical results show that different strategies to fight the disease could be used. Consequently, it is shown that government investment is influenced by the manipulation of these parameters. A numerical package for dynamic optimization with real data taken from the recent outbreak of dengue disease in Cape Verde in 2009 was used.

01357
Muscle Control Model for Postural Stabilization Based on State-Dependent Riccati Equation

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The biomechanic model of a human musculoskeletal system and the simulation of behavior in movement can be applyed in several areas, such as sports, engineering and medicine. The purpose of this work is obtain a dynamic and control model that represents a musculoskeletal system of a human posture. The description of kinematic and dynamic links movements is based on Newton-Euler and Euler-Lagrange formulation. The resulting movements are produced by sets of force actuators muscle-tendinideous.