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keywords: computational complexity, Leontief economy, market equilibrium, Nash equilibrium

We show that there is a one-to-one correspondence between Nash equilibria in bimatrix games and market equilibria in certain Leontief economies. We use this correspondence to prove hardness results for economies. In particular, we show that it is NP-hard to say whether a Leontief economy has an equilibrium.

MO2-R9

GLOBAL OPTIMIZATION

Global optimization methods

chair: Tibor Csendes

Fuzzy control of stochastic global optimization algorithms and very fast simulated reannealing

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keywords: fuzzy control, fuzzy logic, global optimization, simulated annealing

This paper presents a fuzzy control approach for improving convergence time in stochastic global minimization algorithms. We show concrete results when the method is applied to an efficient algorithm based on ideas related to Simulated Annealing. We describe a well-succeeded approach to accelerate ASA (Adaptive Simulated Annealing) algorithm using a simple Mamdani fuzzy controller that dynamically adjusts certain user parameters related to quenching. It is shown that, by increasing the algorithm's perception of slow convergence, it is possible to speed it up significantly and to reduce enormously (perhaps eliminate) the user task of parameter tuning. That is done without changing the original ASA code. The algorithm was successfully applied to neurofuzzy (data driven) synthesis of Takagi-Sugeno-Kang and Mamdani fuzzy systems and MLE (Maximum Likelihood Estimation).

Global optimization algorithms for convex multiplicative programming

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keywords: convex analysis, global optimization, multiplicative programming, numerical methods

We propose new global optimization algorithms for convex multiplicative programs. Elements of convex analysis and multiobjective programming are used for dealing with multiplicative programming problems exhibiting a product or a sum of products of positive convex functions in their objective functions. A global minimum in the first case is obtained by solving a sequence of quasi-concave minimizations on polytopes through vertex enumeration. A global minimum in the second case is obtained by solving a sequence of special indefinite quadratic problems through constraint enumeration. The algorithms proposed are easily implemented and their computational performances have been compared with alternative algorithms from the literature with basis on test problems. Better performances have been obtained with the algorithms proposed in this paper.

A particle swarm pattern search method for bound constrained nonlinear optimization

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keywords: derivative free optimization, direct search, particle swarm, pattern search methods

In this paper we develop, analyze, and test a new algorithm for the global minimization of a function subject to simple bounds without the use of derivatives. The underlying algorithm is a pattern search method, more specifically a coordinate search method, which guarantees convergence to stationary points from arbitrary starting points.

In the optional search phase of pattern search we apply a particle swarm scheme to globally explore the possible nonconvexity of the objective function. Our extensive numerical experiments showed that the resulting algorithm is highly competitive with other global optimization methods also based on function values.

MO2-R10

MULTICRITERIA OPTIMIZATION

Applications of MCDM

chair: Mischel Belderrain

Multiattribute utility theory applied to petrochemical company problem

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keywords: decision analysis, multiattribute utility theory, sensitivity analysis

The objective of this work is to analyze a real-world decision problem of a petrochemical company using the Multiattribute Utility Theory. The business case presented, a decision problem with multiple objectives, considered utility function assignments using both proportional scores and ratio methods, as well as swing weighting, AHP and ordinal methods for weights assignments. Sensitivity analysis has shown that the final solution greatly depends on the weight assignment method; moreover, it also made clear how such weights can be changed without affecting the final result. In addition, this work includes the Decision Analysis theory needed to understand the methodology that was applied to the real business case. Although such methodology points out very interesting insights and directions to reach the best solution, the Decision Analysis Process by itself cannot replace the decision maker.

Multicriteria scheduler for low performance wireless network

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keywords: multicriteria, network, scheduling, wireless networks

In rescue operations, both military and civil defence, it is common the employment of wireless communication networks which are mobile, easy to set and robust, but are often of low performance. In such cases it is mandatory the use of priorities to guarantee to the most valuable information the available communication resources to accomplish the mission. A traditional way to implement that is to use precedence levels and classify information flows into the levels according to their importance. High precedence flows are then serviced first following a strict and static discipline. Such naive scheme has several side effects, e.g. starvation of lower priority flows during congestion. We propose a multiple criteria