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On the convergence of the Mixed Integer Randomized Pattern Search Algorithm

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Abstract : We propose a novel direct search algorithm for identifying at least a local minimum of mixed integer nonlinear unconstrained optimization problems. The Mixed Integer Randomized Pattern Search Algorithm (MIRPSA), so-called by the author, is based on a randomized pattern search, which is modified by the MIRPSA for finding at least a local minimum of our problem. The MIRPSA has two main operations over the randomized pattern search: moving operation and shrinking operation. Each operation is carried out by the algorithm when a set of conditions is held. The convergence properties of the MIRPSA is analyzed using a Markov chain approach, which is represented by an infinite countable set of state space λ, where each state d(q) is defined by a measure of the qth randomized pattern search Hq, for all q in N. According to the algorithm, when a moving operation is carried out on the qth randomized pattern search Hq, the MIRPSA holds its state. Meanwhile, if the MIRPSA carries out a shrinking operation over the qth randomized pattern search Hq, the algorithm will visit the next state, this is, a shrinking operation at the qth state causes a changing of the qth state into (q+1)th state. It is worthwhile pointing out that the MIRPSA never goes back to any visited states because the MIRPSA only visits any qth by shrinking operations. In this article, we describe the MIRPSA for mixed integer nonlinear unconstrained optimization problems for doing a deep study of its convergence properties using Markov chain viewpoint. We herein include a low dimension case for showing more details of the MIRPSA, when the algorithm is used for identifying the minimum of a mixed integer quadratic function. Besides, numerical examples are also shown in order to measure the performance of the MIRPSA.

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