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Efficiency of Robust Heuristic Gradient Based Enumerative and Tunneling Algorithms for Constrained Integer Programming Problems

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Abstract : This paper presents performance of two robust gradient-based heuristic optimization procedures based on 3ⁿ enumeration and tunneling approach to seek global optimum of constrained integer problems. Both these procedures consist of two distinct phases for locating the global optimum of integer problems with a linear or non-linear objective function subject to linear or non-linear constraints. In both procedures, in the first phase, a local minimum of the function is found using the gradient approach coupled with hemstitching moves when a constraint is violated in order to return the search to the feasible region. In the second phase, in one optimization procedure, the second sub-procedure examines 3ⁿ integer combinations on the boundary and within hypercube volume encompassing the result neighboring the result from the first phase and in the second optimization procedure a tunneling function is constructed at the local minimum of the first phase so as to find another point on the other side of the barrier where the function value is approximately the same. In the next cycle, the search for the global optimum commences in both optimization procedures again using this new-found point as the starting vector. The search continues and repeated for various step sizes along the function gradient as well as that along the vector normal to the violated constraints until no improvement in optimum value is found. The results from both these proposed optimization methods are presented and compared with one provided by popular MS Excel solver that is provided within MS Office suite and other published results.

Keywords : constrained integer problems, enumerative search algorithm, Heuristic algorithm, Tunneling algorithm
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