vertical direction. That is why several documents define limits for track quality, taking into account both safety and comfort aspects. This paper presents an application of a developed model for scheduling tamping on ballasted tracks that takes into account the evolution over time of the track degradation, the track's layout, the dependency of track quality recovery on track quality at the moment of maintenance operations and also the track quality limits that depend on train speed. All these aspects are considered in a mathematical programming through suitable constraints, which can be formulated as a mixed 0-1 nonlinear problem. In the present work, the influence of track layout and track quality recovery in scheduling tamping is analysed.

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A Deterministic-Stochastic Method for Non-convex MINLP Problems

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A mixed-integer programming problem is one where some of the variables must have only integer values. Although some real practical problems can be solved with mixed-integer linear methods, there are problems occurring in the engineering area that are modelled as mixed-integer nonlinear programming (MINLP) problems. When they contain non-convex functions then they are the most difficult of all since they combine all the difficulties arising from the two sub-classes: mixed-integer linear programming and non-convex nonlinear programming (NLP). Efficient deterministic methods for solving MINLP are clever combinations of Branch-and Bound (B&B) and Outer-Approximations classes. When solving non-convex NLP relaxation problems that arise in the nodes of a tree in a B&B algorithm, using local search methods, only convergence to local optimal solutions is guaranteed. Pruning criteria cannot be used to avoid an exhaustive search in the solution space. To address this issue, we propose the use of a simulated annealing algorithm to guarantee convergence, at least with probability one, to a global optimum of the non-convex NLP relaxation problem. We present some preliminary tests with our algorithm.

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A Feasible Sequential Convex Programming Method

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In many real world optimization problems, model functions can only be evaluated on a special subset F of the feasible region which is described by additional nonlinear constraints. To ensure feasibility with respect to this subset, it is required that all iterates of an optimization algorithm retain strictly feasible while all the other constraints may be violated during the iteration process. We propose a modification of a sequential convex programming (SCP) method which ensures that the solutions of all subproblems stay in the subset F. The general idea of SCP is to generate a sequence of strictly convex and separable subproblems, where an augmented Lagrangian merit function is applied to perform a line search and to guarantee convergence from arbitrary starting points. In our proposed modification, the resulting