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A Two-Stage Airport Ground Movement Speed Profile Design Methodology Using Particle Swarm Optimization

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Abstract : Automation of airport operations can greatly improve ground movement efficiency. In this paper, we study the speed profile design problem for advanced airport ground movement control and guidance. The problem is constrained by the surface four-dimensional trajectory generated in taxi planning. A decomposed approach of two stages is presented to solve this problem efficiently. In the first stage, speeds are allocated at control points which ensure smooth speed profiles can be found later. In the second stage, detailed speed profiles of each taxi interval are generated according to the allocated control point speeds with the objective of minimizing the overall fuel consumption. We present a swarm intelligence based algorithm for the first-stage problem and a discrete variable driven enumeration method for the second-stage problem since it only has a small set of discrete variables. Experimental results demonstrate the presented methodology performs well on real world speed profile design problems.

Keywords : airport ground movement, fuel consumption, particle swarm optimization, smoothness, speed profile design
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