Computer Science > Systems and Control

Multiple Space Debris Collecting Mission - Debris selection and Trajectory optimization

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A possible mean to stabilize the LEO debris population is to remove each year 5 heavy debris like spent satellites or launchers stages from that space region. This paper investigates the DeltaV requirement for such a Space Debris Collecting mission. The optimization problem is intrinsically hard since it mixes combinatorial optimization to select the debris among a list of candidates and functional optimization to define the orbital maneuvers. The solving methodology proceeds in two steps : firstly a generic transfer strategy with impulsive maneuvers is defined so that the problem becomes of finite dimension, secondly the problem is linearized around an initial reference solution. A Branch and Bound algorithm is then applied to optimize simultaneously the debris selection and the orbital maneuvers, yielding a new reference solution. The process is iterated until the solution stabilizes on the optimal path. The trajectory controls and dates are finally re-optimized in order to refine the solution. The method is applicable whatever the numbers of debris (candidate and to deorbit) and whatever the mission duration. It is exemplified on an application case consisting in selecting 5 SSO debris among a list of 11.

Subjects: **Systems and Control (cs.SY)**; Optimization and Control (math.OC)

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