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## Algorithms for optimal scheduling of multiple spacecraft maneuvers

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Future space missions like on-orbit refueling of satellite constellations or on-orbit debris removal will require the optimization of multiple spacecraft maneuvers. Usually, such a mission requires the determination of an optimal sequence of targets visited by the servicing spacecraft, along with the computation of the optimal trajectory for each orbital transfer. Some problems, such as Peer-to-Peer (P2P) refueling, requires the determination of satellites that make the maneuvers and the optimal trajectory for each maneuvering satellite. Both classes of problems are challenging, which involve a mixture of continuous and discrete decision variables, and belong to the NP-hard class of optimization problems that are difficult to solve. Recently, novel algorithms inspired by the Greedy Random Adaptive Search Procedures (GRASP) have been developed to solve mixed integer nonlinear programming problems that form the crux of both classes of spacecraft maneuver planning problems. GRASP methodology has been widely studied in the field of combinatorial optimization, and have been demonstrated to efficiently compute good-quality sub-optimal solutions for NP-hard assignment problems; these procedures also provide the benefit of parallelization. These algorithms use a two-step methodology: The first step involves creation of basic feasible solutions to the problem using a greedy, random and adaptive methodology, while the second step involves performing local search about the generated basic feasible solution. The solutions generated by the GRASP based algorithms are sub-optimal; however, for P2P refueling problems, they have already shown to compute optimal or near-optimal set of satellite, which pairs with the minimum fuel expenditure during the mission.

### Biography

Atri Dutta is an Assistant Professor in Aerospace Engineering at Wichita State University. Prior to his joining in WSU, he was a Post-doctoral Research Associate at Princeton University and a Research Engineer at Georgia Institute of Technology. All his degrees are in aerospace engineering which includes; Doctor of Philosophy, Master of Science from Georgia Institute of Technology and Bachelor of Technology from Indian Institute of Technology, Kharagpur, India. His research interests are optimal control, space dynamics, optimization and spacecraft design.

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