Porzia Federica Maffione, J Aeronaut Aerospace Eng 2017, 6:2(Suppl)
http://dx.doi.org/10.4172/2168-9792-C1-016

3rd International Conference and Exhibition on

Satellite & Space Missions

May 11-13, 2017 Barcelona, Spain

Sequential quadratic programming and metaheuristic methods applied to low-thrust interplanetary transfers

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Using transcription methods, the trajectory optimization problem can be easily converted into a non-linear programming problem. Once a set of variables and constraints are defined, one of the most efficient methods to optimize the objective function is the sequential quadratic programming. In this work, a tool that combines the SQP with two different types of metaheuristic methods (the particle swarm optimization and the differential evolution) has been developed. The results obtained with the SQP were validated using the MATLAB software FALCON.m developed at the Institute of Flight System Dynamics of Technische Universität of München. Since the PSO and the DE require converting the constrained optimization problem into an unconstrained one, a penalty function with static weights is also provided. In this work, low-thrust interplanetary transfers with electric propulsion are analyzed. The strong correlation between the weights of the penalty function, the number of generations and the accuracy of the solution is shown up with a large variety of examples. Then, the results will show if there is a real advantage using the combined method in terms of computational time and objective function.

Biography

Porzia Federica Maffione completed her Master's degree in Mechatronic Engineering at Polytechnic of Turin. Her project thesis was on Space Propulsion for human spaceflight with Variable Specific Impulse Magnetoplasma Rocket (VASIMR) and the aim of this project was to "Study the optimization problem with indirect method". Currently, she is pursuing PhD at Polytechnic of Turin and her research is about Interplanetary Missions Design for NEP and SEP.

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