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DEVELOPING A NEW OPTIMAL MISSION FOR 79P/DU TOIT–HARTLEY COMET BY FORMATION FLYING OF SPACECRAFTS

Abstract

In this research a New Optimal Mission for 79P/du Toit–Hartley Comet by Formation Flying of Spacecrafts is proposed. The Triple F (Fresh From the Fridge) mission of 79P/du Toit–Hartley, a Comet Nucleus Sample Return, has been proposed to ESA's Cosmic Vision program. A sample return from a comet enables us to reach the ultimate goal of cometary research. Since comets are the least processed bodies in the solar system, the proposal goes far beyond cometary science topics (like the explanation of cometary activity) and delivers invaluable information about the formation of the solar system and the interstellar molecular cloud from which it formed. A spacecraft will launch in April 2018 by a Soyuz launcher to comet 79P/du Toit–Hartley and return 1.5 kg of cooled cometary material in April 2028. In this article based on formation flying a new optimal mission is proposed for this mission. Formation flying has been identified as an enabling technology for many future space missions. Coordinating smaller spacecraft has many benefits over single spacecraft including simpler designs ,faster build times ,cheaper replacement creating higher redundancy unprecedented high resolution , and the ability to view research targets from multiple angles or at multiple times. These qualities make them ideal for future mission of comets. The new optimal mission will transfer three spacecrafts from an initial circular parking orbit to comet 79P/du Toit–Hartley. An important aspect that is critical to the successful implementation of formation flying is trajectory design. The present research is intended to present an algorithm for solving the optimal path planning problem with regard to path design viewpoint for formation flying mission of 79P/du Toit–Hartley. To do so issues such as optimal control theory, orthogonal functions in the Hilbert space and evolutionary optimizations are utilized. Attempts have been made to introduce a new and comprehensive method to cover constrained and unconstrained optimal path planning of formation flying. This research will be applicable proposal for comet 79P/du Toit–Hartley as an optimal mission by formation flying.