Optimal Trajectory Correction Maneuver Design using the B-plane Targeting Method for the Future Korean Mars Missions

Young-Joo Song[1], Eun-Seo Park[1], Sung-Moon Yoo[1],
Sang-Young Park[1], Kyu-Hong Choi[1], Jea-Cheol Yoon[2],
Jo Ryeong Yim[2], Joon-Min Choi[2], and Byung-Kyo Kim[2]

[1]CAST, Department of Astronomy and Space Science, Yonsei University
[2]Korea Aerospace Research Institute

Optimal Trajectory Correction Maneuver (TCM) design algorithm has been developed using the B-plane targeting method for the future Korean Mars missions. TCMs are needed during the cruising phase of interplanetary missions, because of various uncertainties caused by many perturbations and unexpected errors while operating impulsive maneuvers. The design of these maneuver requires arrival targeting technique, which involves the B-plane. Developed optimal algorithm controls each component of TCM's velocity increments(delta-v) while minimizing the total amount of their magnitude. And also, executing time of maneuvers can be controlled for the user defined number of TCMs. Constraints to meet the optimal conditions are the final B-plane coordinate conditions at the Mars arrival. NPSOL, based on SQP algorithms, is used to solve these optimal control problems. For verifications, the results are compared to the results from STK's Astrogator module. Future Korean Mars missions can be designed and analysed by using this TCM design strategy.