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THE ALDRIN CYCLER IMPROVED BY THE LORENTZ FORCE

Abstract

Enable safe human space exploration beyond low-Earth orbit, including sending humans to Mars, is one of the objectives of several space agencies. A spacecraft placed on a trajectory that periodically encounters the Earth and Mars has been proposed as a transportation system for human missions to Mars. It could offer a large living and working environment for astronauts flying to and from Mars, at reduced costs. The simplest trajectory possible for this system is the Aldrin cycler first introduced by the former astronaut Buzz Aldrin. The orbit is mainly maintained by gravity-assist flybys around Earth and Mars. However, some propulsive maneuvers are still required at irregular intervals. This study proposes a new version of the Aldrin cycler using the Lorentz force at encounter with the Earth to improve the flyby around the planet. A Lorentz-augmented gravity-assist flyby provides more flexibility and enables a variation of the turn angle and the total orbital energy of the flyby using the planet's magnetosphere. The intent is to reduce the need for propulsive maneuvers to maintain the cycler on its orbit. A deep analysis of the orbital mechanics of the Lorentz-augmented cycler is performed. A comparison between this new version of the Aldrin cycler and the classical Aldrin cycler is presented over 15 years. The save in propellant is computed.