

SPACE DEBRIS SYMPOSIUM (A6)  
Space Debris Removal Concepts (6)

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DISABLED SATELLITE REMOVAL BY THREE COORDINATED ELECTROMAGNETIC  
SPACECRAFT**Abstract**

With the application of inter-spacecraft electromagnetic force, disabled satellite with functional magnetorquer could be non-contacting removed without propellant expenditure and complicated docking or capture mechanism. This paper investigates the working configuration design, equilibrium condition solution and corresponding controller design of the three electromagnetic spacecraft for removing a disabled satellite. Firstly, several configurations of the three electromagnetic spacecraft are analyzed and a working configuration is selected, which mainly concentrate on the control capability of the relative position and the attitude with respect to the disabled satellite and the other spacecraft. Secondly, the equilibrium conditions of the working configuration, e.g., the analytical solutions of the magnetic moments of the three electromagnetic spacecraft, are optimal solved. Thirdly, a novel control approach which combines the Artificial Potential Function (APF) method and the Linear Quadratic Regulator (LQR) is applied to design the controller of configuration maintaining. Fourthly, several numerical simulations are implemented to validate these theoretical deduction results. Lastly, the disabled satellite removal efficiency corresponding to different number of electromagnetic spacecraft is discussed, and some considerations for future on-orbit application are given.