



Full Magnetic Field Gradient from Two Spacecraft Measurements under Special Constraints

Chao Shen (1), Zhaojin Rong (2,3), and Malcolm Dunlop (4)

(1) Center for Space Science and Applied Research, Chinese Academy of Sciences, China (sc@nssc.ac.cn), (2) CAS Key Laboratory of Ionospheric Environment, Institute of Geology and Geophysics, Chinese Academy of Sciences, (3) Beijing National Observatory of Space Environment, Institute of Geology and Geophysics, Chinese Academy of Sciences, (4) Rutherford Appleton Laboratory, Didcot, UK

In this investigation, it is revealed for the first time that the full magnetic field gradient and current density distribution can be derived from two spacecraft magnetic field measurements when the magnetic field is approximately stationary and force-free, conditions which are particularly relevant to low altitude regions of the Earth's magnetosphere and in the regions containing the field aligned current systems. The magnetic field gradients along the spacecraft line, spacecraft velocity direction and the normal direction can be defined so that the full magnetic field gradient tensor is determined, projected into any coordinate system. One test for an ideal situation has been made, which confirms the validity of this approach with very high accuracy. This method can be applied to the determination of the magnetic field gradient tensor and current density for the forthcoming multi-spacecraft Swarm mission and other two satellite missions.