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Efficiency of the FOTE method in identifying magnetic reconnection

Huishan Fu (1), Jinbin Cao (1), Andris Vaivads (2), Yuri Khotyaintsev (2), Mats Andre (2), Malcolm Dunlop (1), Wenlong Liu (1), Haoyu Lu (1), Shiyong Huang (3), Yuduan Ma (1), and Elin Eriksson (2)

(1) Space Science Institute, Beihang University, Beijing, China (huishanf@gmail.com), (2) Swedish Institute of Space Physics, Uppsala, Sweden, (3) School of Electronic and Information, Wuhan University, Wuhan, China

A magnetic reconnection event detected by Cluster is analyzed using three methods: Single-spacecraft Inference based on Flow-reversal Sequence (SIFS), Multi-spacecraft Inference based on Timing a Structure (MITS), and the First-Order Taylor Expansion (FOTE). Using the SIFS method, we find that the reconnection structure is an X-line; while using the MITS and FOTE methods, we find it is a magnetic island (O-line). We compare the efficiency and accuracy of these three methods, and find that the most efficient and accurate approach to identify a reconnection event is FOTE. Even in the guide-field reconnection, the FOTE method still works. This study for the first time demonstrates the capability of FOTE in identifying guide- and non-guide-field reconnection. It would be useful to the NASA MMS mission.