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Detection of Ionospheric Scintillation Effects Using LMD–DFA

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Abstract

The performance and measurement accuracy of global navigation satellite system (GNSS) receivers is greatly affected by ionospheric scintillations. Rapid amplitude and phase variations in the received GPS signal, known as ionospheric scintillation, affects the tracking of signals by GNSS receivers. Hence, there is a need to investigate the monitoring of various activities of the ionosphere and to develop a novel approach for mitigation of ionospheric scintillation effects. A method based on Local Mean Decomposition (LMD) – Detrended Fluctuation Analysis (DFA) has been proposed. The GNSS data recorded at Koneru Lakshmaiah (KL) University, Guntur, India were considered for analysis. The carrier to noise ratio (C/N_0) of GNSS satellite vehicles were decomposed into several product functions (PF) using LMD to extract the intrinsic features in the signal. Scintillation noise was removed by the DFA algorithm by selecting a suitable threshold. It was observed that the performance of the proposed LMD–DFA was better than that of empirical mode decomposition (EMD)–DFA.

Key words: detrended fluctuation analysis, empirical mode decomposition, global positioning system, ionospheric scintillations, local mean decomposition.

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