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Application of Least Square Spectral Analysis for Estimation of Precise Coordinates of Permanent GPS Station and Modeling Systematic Effects: A Practical Contribution to Nonlinear Time Series Analysis in Geodesy

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Based on continuity of permanent GPS station observations and the fact the most of the environmental and instrumental affects are time dependent, it is expected that those effects could be successfully observed and modeled from the time series of GPS observations. Having this idea in mind, we used least-squares spectral analysis to extract linear trend and sinusoidal constituents of the one-year time series of the coordinates {x,y,z} of permanent GPS station of the Department of Surveying and Geomatics Engineering of University of Tehran at one day intervals. The main character of the time series of permanent GPS stations is the time interval irregularities that may occur in the time series of observations, especially when they are processed for daily coordinate computations, a short interruption in receiving the GPS signal can cancel the whole observations of a day. This characteristic limits the use of those techniques, such as Fourier, which require equal interval time series, and explains why we have used Gauss-Vanicek Least-Squares spectral analysis method (Computing in Science and Engineering 8: 26-30) for our computations. Final product of this study is the linear trend, amplitude and frequency of harmonic constituents of the time series of the coordinates, which is used for modeling and removing of the systematic effects and obtaining the precise coordinates of the permanent GPS stations after removal of the modeled effects.