

# **FOURIER ANALYSIS OF GPS-LEO RADIO OCCULTATION SIGNALS, RESOLUTION AND LIMITATIONS**

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A Fourier analysis of GPS-LEO radio occultation signals can be performed in two principal different ways: A local Fourier transform, where a relative short time slot of the signal is analyzed, or a global Fourier transform where the whole time record of the signal is analyzed. The local, or the sliding Fourier transform, is well known whereas use of the global Fourier transform is new and has only recently been submitted for publication. The primary conditions for the global Fourier transform technique to work on a time signal is (1), that the instantaneous frequency of the signal (the Doppler frequency) is monotonous in time and (2) that the amplitude of the signal is slowly varying compared to the signal variation caused by the phase of the signal. When (1) and (2) are fulfilled the stationary phase method can be applied and the time can be mapped into frequency space, i.e., the time can be obtained by the derivative of the Fourier phase with respect to frequency. A geometrical model for a radio occultation signal will in general fulfill conditions (1) and (2) and if this model gives an adequate description of real radio occultation signals, the use of the global Fourier transform method will have several advantages compared to present processing methods in form of simplicity, resolution and capability to detect multipath. However, in special cases problems will occur. This is the main issue of this paper.

The limitations of the Fourier methods will be investigated by analyzing the detection process of the radio occultation signal. Especially, the effect of sampling rate on the radio occultation signal will be studied. A preliminary conclusion of this investigation is that the limitations of the Fourier methods (among others) are only caused by limitations induced by the signal detection process.