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# Kinematical LEO Precise Orbit Determination (POD) with only sequential time differenced GPS SST carrier phase observations

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SST (Satellite to Satellite Tracking) observations between GPS and LEO (Low Earth Orbiter) play an important role for the determination of precise orbits of LEO satellites. These precise orbits are indispensable within the in-situ gravity field recovery procedure based on the in-situ analysis of the satellite's dynamics. In this article a special technique to determine precise semi-analytical continuous orbits of short arcs of LEO is proposed. The method is based on the solution of Newton's equation of motion solved as a boundary value problem, constituting the physical model, and zero difference LEO GPS SST carrier phase observations as measured quantities. The procedure allows to determine the orbits in the dynamical and the kinematical mode and everything in-between, considered as so-called reduced dynamic mode of varying level, depending on how much dynamic information is introduced into the orbit determination procedure. In this work, only the kinematical orbit determination mode is investigated. The satellite arcs are represented in the spectral domain. Special polynomials (i.e. Euler-Bernoulli polynomial) have to be used to avoid Gibbs' effects at the boundaries of the arcs. The precisely kinematically determined short arcs can be used for regional as well as for global gravity field recovery based on the POD (Precise Orbit Determination) in-situ technique.