Time-Delay Interferometry and Clock Noise Calibration for LISA

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The gravitational wave observatory LISA is a joint ESA/NASA mission designed to detect graviational waves in the mHz range. It consists of three spacecraft, each equipped with several interferometers measuring the distances between the spacecraft as well as the relative position of each spacecraft to free-falling reference test masses housed inside them.

These measurements are combined using a post-processing technique called Time-Delay Interferometry. It uses the interferometric one-way measurements to construct virtual equal arm length interferometers, which suppress the otherwise overwhelming laser frequency noise by several orders of magnitude.

Besides the primary noise source of laser frequency noise, other secondary noise sources such as phase fluctuations of the reference oscillators used to record the MHz beatnotes onboard also need to be suppressed as part of TDI.

In this talk, I will review the currently envisioned clock calibration algorithm, which is compatible with second generation TDI combinations. I will discuss the estimation of residual noise levels after the calibration, including the effect time-varying arm lengths and onboard anti-aliasing filters have on these residuals. I will also compare these analytical results to simulations done with the prototype end-to-end simulator LISANode.