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# A digital filter method to analyze non-linear contributions to the angle-to-length noise coupling

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The next generation of gravitational wave detectors is confronted with intricate challenges, highlighting the need for state-of-the-art simulation tools tailored to these emerging complexities. Many of these challenges cannot be accurately modeled with existing frequency-domain tools due to their non-linearities and therefore need to instead be modeled in the time domain. This work develops a method using a digital filter, based on the output of a frequency-domain model with good agreement to the beam spot motion in the Virgo arm cavities, to produce mirror motion in the time-domain and study the non-linear contributions to the angle-to-length noise coupling.

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