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Octopyus: A Frequency-Domain Simulation Tool for Superattenuator Suspensions

The next generation of ground-based gravitational wave detectors will push the boundaries of our understanding of the Universe. The Einstein Telescope aims to surpass current observatories by achieving unprecedented sensitivity, particularly at low frequencies. This improvement relies on advanced seismic attenuation systems, crucial for reducing environmental noise and enhancing detection capabilities.

In this talk, we present Octopyus, a software developed for the mechanical simulation of a superattenuator suspension. The tool is based on the impedance matrix method, enabling system modeling in the frequency domain. Designed for accessibility, Octopyus automates the computational process, allowing users to perform simulations without requiring in-depth knowledge of the underlying mathematical framework. The software includes standard passive components found in superattenuators and is structured to incorporate active control systems.

We will showcase simulated frequency responses and compare them with results from other simulation tools. Additionally, we will analyze thermal noise behavior under different conditions, demonstrating the software' s potential in refining suspension system design for next-generation gravitational wave detectors.

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