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A chip-scale, optical-cavity-based dynamic force sensor BENJAMIN RESCHOVSKY, JQI-University of Maryland, NICHOLAS VLAJIC, AKOBUIJE CHIJIOKE, NIST — Measuring dynamic forces is extremely important for a variety of industrial process. However, the typical methods used to measure dynamic forces are not SI-traceable and suffer from poorly understood uncertainties. Since dynamic calibration is often difficult, a common practice is to assume a static calibration is valid over the entire tested bandwidth instead of performing a calibration of the true dynamic response of a force transducer, introducing an unknown amount of error. This approach is only accurate at frequencies much less than the lowest mechanical resonance of the transducer where the dynamic response is nearly flat. We describe a new type of force transducer based on high-quality, monolithic optical cavities. As a force is applied to the device, the dimensions of the cavity are slightly deformed leading to a shift in the cavity resonance frequency. This frequency shift can be detected with a differential measurement scheme, allowing for the cancellation of drifts due to environmental fluctuations such as temperature. The optical cavity approach is appealing because it should lead to compact, stiff devices with large mechanical resonance frequencies, high sensitivity, and high linearity.

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