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Improved Design of Two-Wave Interferometers for High-Precision Sensors

Researchers at Stanford have modified the spatial construction of two-wave interferometers to enable high-precision acoustic sensors and accelerometers produced at scale. This is realized with the principle of near-zero-order interferometry using a spring-loaded Si MEMS diaphragm wherein sensitivity is **set precisely** during micro-fabrication of the diaphragm structure and **weakly dependent** on wavelength and temperature. The novel, interdigitated configuration developed at Stanford facilitates **large-scale, mass production** of such high-precision sensors with uniform sensitivity. This solution provides **two main advantages**: (*1*) misalignments between the fiber and the chip, which are inevitable during assembly, will have negligible impact on the optical sensitivity of the two-wave interferometer. (*2*) The design ensures that the sensitivity across many sensors will remain within a tight margin of the optimal sensitivity of the two-wave interferometer.

Stage of Development
The best performance of the sensors are 2 µPa/?Hz as microphones and 550 ng/?Hz as accelerometers.

Applications

- High-precision acoustic sensors
- Underwater hydrophone arrays (underwater acoustic communication and surveillance)
- Accelerometers for strategic-grade inertial navigation units
- Biomedical acoustic/ pressure sensors

Advantages

- Reproducible sensitivity at scale
- Easy and quick assembly procedure
- Ease of multiplexing into sensor arrays
- High detection resolution

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