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Underwater tensor sensors based on optical fiber bragg gratings

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This paper deals with the development a new type of low-noise underwater tensor sensor aimed at improving the performance and the design of directional arrays. The transducer can be configured either as a particle velocity sensor (dipole) or as fluid shear sensor (quadrupole). The sensing principle of the device relies on the interference signal from two Bragg gratings written on the same fiber, and illuminated by a tunable, narrowband light source. The gratings are a few centimeters apart, and they each reflect a portion of the incident light. The fiber is epoxied to two spacers separated by a small gap situated between the gratings. This assembly is then adhered to two plates connected by a hinge, which is located below the gap. One plate is held rigidly and the tip of the other (free) plate experiences transverse vibrations, when ensonified. These vibrations produce periodic gap length changes, which modulate the interference signal from the two gratings. The modulation is related to the amplitude of the sound wave and is monitored with a photodetector. A noise analysis will be presented and the performance of prototype sensors will be discussed.