

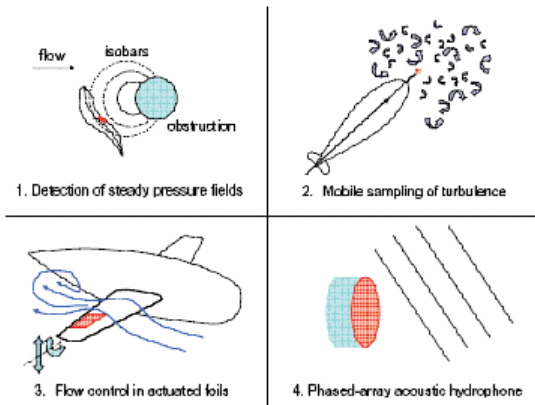
# MEMS Pressure-sensor Arrays for Passive Underwater Navigation

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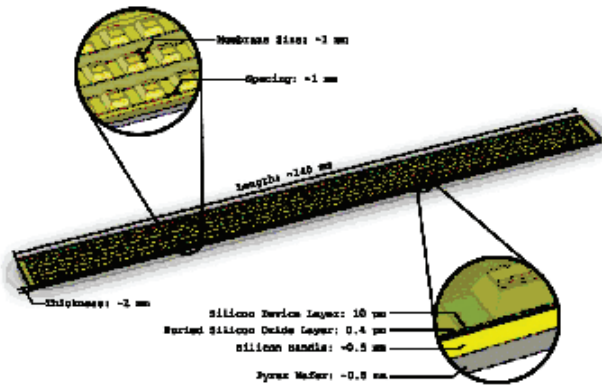
MEMS pressure sensors have had broad applications in fields such as mining, medicine, automobiles, and manufacturing. Another application to be explored is in underwater vehicular navigation. Objects within a flow generate pressure variations that characterize the objects' shape and size. Sensing these pressure variations allows the unique identification and location of obstacles for navigation (Figure 1). This concept is inspired by existing biological systems. Fish have such a sensory lateral line, which they use to monitor all aspects of their hydrodynamic environment, including obstacles [2,5].

We propose to develop low-power sensors that passively measure dynamic and static pressure fields with sufficient resolution to detect objects generating the disturbance. We will also develop processing schemes that use the information from the sensors to identify objects in the

flow environment. These sensors and processing software emulate the capabilities of the lateral line in fish. While active acoustic means can be used for object detection, the process is power-intensive, and depends strongly on the acoustic environment. A simpler alternative is to use a passive system that can resolve the pressure signature of obstacles. The system consist of arrays of hundreds or thousands of piezoresistive pressure sensors fabricated on etched silicon and Pyrex wafers [1,3,4,6] with diameters around 1 mm; the sensors are arranged over a flat or curved surface in various configurations, such as a single line, a patch consisting of several parallel lines (Figure 2), or specialized forms to fit the hull shape of a vehicle or its fins. The sensors will be packaged close together at distances of a few millimeters apart in order to resolve pressure and flow features near the array spacing, which in turn can be used to identify the overall features of the flow.



▲ Figure 1: Pressure-sensor array applications.



▲ Figure 2: Diagram of pressure-sensor array with basic structure depicted.

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