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MATCHED SENSORS FOR STRUCTURE BORNE NOISE CANCELLATION ON HULL MOUNTED HYDROPHONES

E. KJELLSBY

Norwegian Defence Research Establishment, Horten, Norway

A hydrophone to suppress self-noise was built based on the principle of cancelling acceleration sensitivity. Two sensors are mechanically coupled to the hull but only one of them is exposed to the water. Subtracting the two signals cancels structure borne noise by destructive interference while a water borne signal remains unaltered.

The principle demands that the noise signal from the two sensors be in phase. Structure borne noise has its origin in a complex form of vibration with poor correlation properties. To obtain sufficient correlation, both sensors have to sense the vibration at approximately the same point. By coupling concentric two cylindrical ceramic tubes of different diameter to the hull, this condition is nearly fullfilled. The outer tube is end capped and airfilled. To compensate the inner tube for the water load at the end cap of the outer, it is equipped with an inertial mass load.

The vibration sensitivity of a ceramic tube will normally not be equal in all planes. However, if the ratio between the sensitivities of the two main directions of vibration of the two tubes are made equal, cancellation will occur in both planes. This matching can be done adjusting the mass load and weighting of the two sensitivities.