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Sensing Small Changes in a Wave Chaotic Scattering System
BINIYAM TADDESE, JAMES HART, THOMAS ANTONSEN, EDWARD OTT, STEVEN ANLAGE, University of Maryland, College Park — We had demonstrated a new remote sensor scheme by applying the wave mechanical concept of fidelity loss to classical waves. The sensor makes explicit use of time- reversal invariance and spatial reciprocity in a wave chaotic system to sensitively and remotely measure the presence of small perturbations to the system [1]. The loss of fidelity is measured through a classical wave-analog of the Loschmidt echo by employing a single-channel time-reversal mirror to rebroadcast a probe signal into the perturbed system. We now compare and contrast the detection power and computational efficiency of our sensor with other techniques such as correlation and/or mutual information of probing signals. We also introduce the use of exponential amplification of the probe signal to partially overcome the effects of propagation losses. It is demonstrated that exponential amplification can be used to vary the spatial range of sensitivity to perturbations, and the extent to which the spatial range of the sensors can be varied. Experimental results are presented for the acoustic version of the sensing techniques under study.

[1] B. T. Taddese, *et al.*, Appl. Phys. Lett. 95, 114103 (2009) (http://link.aip.org/link/?APPLAB/95/114103/1)

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