14th September 2018

Magnetoelectric Gradiometer with Enhanced Vibration Rejection Efficiency under H-Field Modulation

Junran Xu, Xin Zhuang, Chung Ming Leung, Jiefang Li and Dwight Viehland

Materials Science and Engineering Department, Virginia Tech, Blacksburg, VA

Abstract

A magnetoelectric (ME) gradiometer consisting of two Metglas/Pb(Zr,Ti)O_3 (PZT) fiber-based sensors has been developed. The equivalent magnetic noise of both sensors was first determined to be about 60 pT/√Hz while using an H-field modulation technique. The common mode rejection ratio (CMRR) of a gradiometer based on these two sensors was determined to be 74. The gradiometer response curve was then measured, which provided the dependence of the gradiometer output as a function of source-gradiometer-normalized distance. Investigations in the presence of vibration noise revealed that a ME gradiometer consisting of two ME magnetometers working under H-field modulation was capable of significant vibration rejection. The results were compared to similar studies of ME gradiometers operated in a passive working mode. Our findings demonstrate that this active gradiometer has a good vibration rejection capability in the presence of both magnetic signals and vibration noise/interferences by using two magnetoelectric sensors operated under H-field modulation.

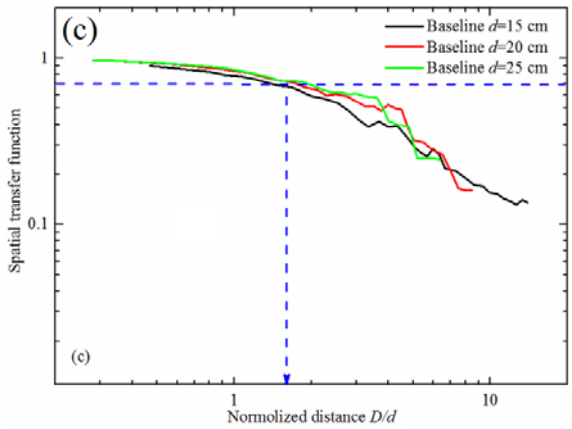

Figure: Gradiometer response curve as a function of distance between ME gradiometer and magnetic source normalized to baseline.

Biography

Junran Xu (June Rain Shyu) is a PhD student in MSE department. He received his bachelor's degree of electrical engineering from Macau University of Science and Technology in 2008. He has been working in Prof. Viehland's group since 2015, and he expects to complete in 2020. His current research focuses on the noise floor measurement of magnetoelectric (ME) sensors which are composed by PZT layers and Metglas layers, and he also works on the vibration rejection of ME gradiometers which are composed by two ME sensors.