Investigation of Cross-Coupling in Piezoelectric Transducer Arrays and Correction

Abdelmajid Bybi1,*, Sébastien Grondel2, Ahmed Mzerd3, Christian Granger4, Mohammed Garoum1, Jamal Assaad2

1Mohammed V University in Rabat, High School of Technology in Sale, MEAT, Sale, Morocco
2Polytechnic University (UPHF), IEMN, UMR CNRS 8520, OAE Department, Valenciennes, France
3Mohammed V University in Rabat, Faculty of Science, STCE, Energy Research Center, Rabat, Morocco
4ISEN Department, IEMN, UMR CNRS 8520, Lille, France

Received 04 May 2019; received in revised form 02 June 2019; accepted 04 July 2019

Abstract

Cross-coupling in piezoelectric transducer arrays is an undesirable phenomenon which decreases the performance of these devices. Indeed, when one element of a transducer is driven, it generates parasitic displacement fields at the radiating surfaces of the neighboring elements, which changes the directivity of the array. The objective of this paper is to investigate the cross-coupling effects on the piezoelectric transducer arrays performance and to propose solutions to reduce this parasitic phenomenon. In this context, it is demonstrated that a filling material having high mechanical losses contributes to the reduction of cross-coupling. In addition to this, a procedure of active cancellation of cross-coupling is successfully tested in the case of two transducer arrays vibrating in the transverse mode for the first prototype and thickness mode for the second one. Finally, the ability of the method is demonstrated even when the displacement at the radiating surface of the transducer array is not uniform.

Keywords: cross-coupling, piezoelectric transducer arrays, correction method

References


* Corresponding author. E-mail address: abdelmajid_bybi@hotmail.fr
Tel.: +212-6-39668291; Fax: +212-5-37881564


Copyright© by the authors. Licensee TAETI, Taiwan. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY-NC) license (https://creativecommons.org/licenses/by-nc/4.0/).