

MASTER

## Self System Identification of a massive MIMO Phased Array of Ultrasound Transducers

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Department of Mechanical Engineering  
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# Self System Identification of a massive MIMO Phased Array of Ultrasound Transducers

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This report was made in accordance with the TU/e Code of Scientific Conduct for  
the Master thesis

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## Abstract

This MSc thesis regards an MSc graduation project within the research group Dynamics & Control within the Department of Mechanical Engineering at the Eindhoven University of Technology (TU/e). A method is established in this project and is described in this thesis for multi-input multi-output (MIMO) system identification of a phased array of piezo-electric ultrasound transducers.

The identification method is based on frequency response measurements, where a least-squares curve-fit algorithm with a parametric model is applied to the frequency response results, returning the separate characteristics of the sending and receiving transducer. The method is first investigated for a single-input single-output case and is then extended to a MIMO case with an Orthogonal matrix approach, making it more efficient for a massive MIMO phased array of transducers.

The method is implemented into an actual phased array system of ultrasound transducers and was able to retrieve the separate frequency responses of each of the transducers in the system. The method is completely automated and takes approximately 1 minute in total, making it pleasant to work with if sequential identification tests are to be performed.

Any variations in the characteristic of the transducers, which might come from fabrication tolerances or environmental variations, can now be identified. A correction for these variations can then be applied so that the phased array of transducers produces a result that is closer to what is expected.

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