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Feifei Zhao, Jianwen Luo

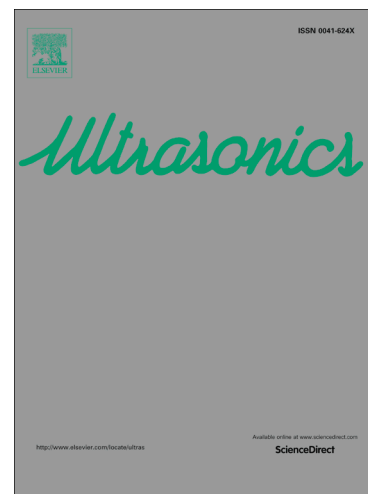
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Diverging wave compounding with spatio-temporal encoding using orthogonal Golay pairs for high frame rate imaging

Feifei Zhao and Jianwen Luo

Department of Biomedical Engineering, School of Medicine, Tsinghua University
Beijing 100084, China

Abstract

Golay coded excitation for diverging wave compounding (DWC) has been demonstrated to increase the signal-to-noise ratio (SNR) and contrast for high frame rate cardiac imaging. However, the complementary codes need to be transmitted in two consecutive firings for decoding, which reduces the frame rate by 2 folds. This paper proposes an orthogonal Golay pairs coded (OGPs-coded) DWC sequence to overcome this problem, which implements spatio-temporal encoding for DWC. Two diverging waves (DWs) at different steering angles coded by an orthogonal Golay pair are transmitted *simultaneously*, thus compensating the frame rate reduction caused by transmissions of complementary codes. The two DWs can be separated based on the orthogonality of Golay pairs. To test the feasibility of the proposed sequence, we performed simulations of point targets and tissue phantoms in both static and moving states. Compared with non-coded DWC at the same frame rate, OGP-coded DWC obtains comparable resolution, SNR gains of 7.5-10 dB and contrast gains of 3-5 dB. The OGP-coded DWC sequence was also tested experimentally on a tissue-mimicking phantom. Compared with non-coded DWC, OGP-coded DWC achieves improvements in the SNR (3-6 dB) and contrast (1-2 dB). Preliminary *in vivo* results show brighter myocardium and larger penetration depth with the proposed method. The proposed OGP-coded DWC sequence has potential for high frame rate and high quality cardiac imaging.

Keywords: Diverging wave compounding; Golay codes; high frame rate; orthogonal

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