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Localization of continuous acoustic emission sources using cross-correlation and time reversal signal processing

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Localization of continuous acoustic emission (generated, e.g. by leakage) is a very important problem in the field of non-destructive testing, but especially due to wave dispersion, velocity, and/or geometry changes the localization is still a challenge. An effective tool to overcome these problems is time reversal (TR) signal processing, which works very well in the case of burst acoustic emission signal localization. In the case of continuous acoustic emission TR itself does not give so satisfactory results, and the cross-correlation itself also does not give good results, but a combination of TR and cross-correlation provides very precise localization. In our experiment we used a piezoelectric transmitter to emit a leakage (recorded at a real leak), signals were recorded at different positions of the plate, time-reversed, and rebroadcast back to the structure using the reciprocal TR method. For precise localization, detailed surface scanning around the roughly estimated source position was necessary. The scanning may be realized e.g., by a scanning laser interferometer. The experimental results show the successful application of TR signal processing in continuous acoustic emission localization.

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