# Least-squares reverse time migration (LSRTM) for damage imaging using Lamb waves

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Reverse-time migration (RTM) is an effective damage imaging technique for both metallic and composite plates [1, 2]. Incorporating least-squares inversion into migration can generate images with improved resolution and suppressed artifacts [3, 4]. Large-area monitoring and accurate damage quantification are two primary goals of ultrasonic, guided wave-based structural health monitoring (SHM). Development of a least-squares reverse time migration (LSRTM) technique is promising since it could expand the imaging area for a given sensor array while maintaining relatively high resolution. Furthermore, the imaging technique can estimate damage reflectivity, which can be used to quantify its severity [5]. A LSRTM technique is introduced in this research for damage imaging in an isotropic plate using $A_0$ mode Lamb waves. A finite difference algorithm based on the Mindlin plate theory was used to simulate the flexural wave propagation. To form the theoretical foundations for guided wave-based LSRTM, a modeling operator and its adjoint are defined. The damage images show that LSRTM can enhance imaging resolution, reduce artifacts, and improve damage reflectivity estimation over iterations.

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**References:**

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