# The kernel-based collocation methods for elastic wave obstacle scattering problems

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## Abstract

Elastic wave scattering problems have wide applications in the medical and military fields. Considering the mesh independence and geometrically flexible nature of the kernel-based collocation methods, this paper applies the Kansa method and the weighted least-squares collocation method (WLS) to solve time-harmonic plane elastic scattering wave problems with regular and irregular rigid obstacles. The WLS method requires the collocation set denser than the trial centers, and least-squares formulations are obtained by imposing different weights on boundary collocation terms. It has been proved that the WLS method is convergent for elliptic equations with Dirichlet boundary conditions and mixed boundary conditions. The elastic wave propagation is firstly modeled by the two-dimensional Navier equation with Dirichlet boundary conditions and Helmholtz equations with coupled boundary conditions. The perfect matched layer (PML) is used to truncate the unbounded physical domain into a bounded computational domain, which can eliminate the wave reflection. By comparing the accuracy and convergence behavior of two collocation methods and the mesh dependent methods, it is demonstrated that the collocation methods are more accurate and stable. Furthermore, the numerical solution to the elastic wave scattering problem with irregular obstacles is simulated and obtained with the desired accuracy.

**Keywords:** Elastic obstacle scattering, perfectly matched layer (PML), collocation methods, radial basis functions