# Comparative analysis of the weighted finite element method and FEM with mesh refinement

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**Abstract:** The generalized solution of the boundary value problem for the Lamé system in a two-dimensional domain with a boundary containing a reentrant corner $\gamma$ belongs to the space $W_2^{1+\alpha-\varepsilon}(\Omega)$, where $0.25 \leq \alpha \leq 0.63$ for $3\pi/2 \leq \gamma \leq 2\pi$, and $\varepsilon$ is any positive number. Therefore, the approximate solution produced by classical finite element or finite difference schemes converges to a generalized solution no faster than at $O(h^\alpha)$ rate.

We defined for boundary value problems with strong and weak singularities, the solution as an $R_\nu$-generalized one in a weighted Sobolev space or set. Relying on this approach, numerical methods were created with a rate of convergence independent of the size (value) of the singularity [1-3].

In this report we consider the Lamé system posed in a domain with the reentrant corner of $3\pi/2$. We construct a version of the weighted finite element method (FEM) on the base of a definition of the $R_\nu$-generalized solution. We performed a comparative numerical analysis of the weighted finite element method and FEM with mesh refinement for finding an approximate solutions of model problems of elasticity theory in the L-shaped domain. A weighted FEM allows one to find a solution with theoretical accuracy on meshes of high dimension. The finite element method with mesh refinement fails at mesh high dimensions and the same calculation conditions. We carry out a comparative analysis of the absolute errors of these methods for a model boundary value problem for the Lamé system in an L-shaped domain.

**Keywords:** Boundary value problems with a singularity, weighted finite element method

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## References

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