

# The Trefftz method using fundamental solutions for biharmonic equations

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## Abstract

In this paper, the Trefftz method of fundamental solution (FS), called the method of fundamental solution (MFS), is used for biharmonic equations. The bounds of errors are derived for the MFS with Almansi's fundamental solutions (denoted as the MAFS) in bounded simply connected domains. The exponential and polynomial convergence rates are obtained from highly and finitely smooth solutions, respectively. The stability analysis of the MAFS is also made for circular domains. Numerical experiments are carried out for both smooth and singularity problems. The numerical results coincide with the theoretical analysis made. When the particular solutions satisfying the biharmonic equation can be found, the method of particular solutions (MPS) is always superior to the MFS and the MAFS, based on numerical examples. However, if such singular particular solutions near the singular points do not exist, the local refinement of collocation nodes and the greedy adaptive techniques can be used for seeking better source points. Based on the computed results, the MFS using the greedy adaptive techniques may provide more accurate solutions for singularity problems. Moreover, the numerical solutions by the MAFS with Almansi's FS are slightly better in accuracy and stability than those by the traditional MFS. Hence, the MAFS with the AFS is recommended for biharmonic equations due to its simplicity.

Keyword : method of fundamental solution (MFS), biharmonic equations, Almansi's fundamental solutions, method of particular solutions (MPS), the greedy adaptive techniques