 Proceedings of ICCES'08, pp.1525-1525

MFS FOR POTENTIAL FLOW PROBLEMS: A STUDY OF DIFFERENT FORMULATION ISSUES

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Summary

This paper describes the application of the method of fundamental solutions to steady state potential flow problems [1]. The solution in two dimensional Cartesian coordinates is represented with respect to the following expansions: (A) the fundamental solution of the Laplace equation, (B) the normal derivative of the fundamental solution of the Laplace equation, (C) the use of the first order polynomial augmentation with (A), and with (B). The collocation is used for determination of the expansion coefficients in all cases. Artificial boundary is used for positioning of the source points in case (A). The case (B) is solved through two source point position variants: (1) by using the artificial boundary, and (2) by using the same source and collocation points, and by employing the desingularisation technique [2]. The accuracy of the different variants is studied in case of potential flow around circle which exhibits analytical solution. The errors in L1 and L2 norms are assessed with respect to potential, velocity components, and absolute velocity. The variants (A) and (B) give almost identical results when employing artificial boundary. The augmentation does not influence the accuracy of the solution near the circle, however it improves the accuracy of the undisturbed flow. The use of the desingularisation technique gives worse results for coarse discretisation, and approaches solutions with artificial boundary [3] for fine discretisation.

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