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Interpolating stabilized moving least squares (MLS) approximation for 2D elliptic interface problems

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Abstract

The main aim of the current paper is to propose a new truly meshless numerical technique to solve the one- and two-dimensional elliptic interface problems. The employed meshless approach is based on a new class of MLS approximation. The numerical procedure is based on the interpolating stabilized MLS (ISMLS) approximation. The new shape functions that have been made by the ISMLS technique, have the δ-Kronecker property thus the Dirichlet boundary conditions can be applied, directly. In the current investigation, we propose a meshless collocation method for solving elliptic interface problems based on the shape functions of ISMLS technique. Several test problems with sufficient complexity have been studied to check the accuracy and efficiency of the new numerical procedure. Moreover, test problems show the acceptable accuracy and efficiency of the proposed scheme.

Keywords: Elliptic interface problems, Interpolating stabilized moving least squares approximation, complex computational domains, Jump boundary conditions, meshless method.

AMS subject classification: 82B24, 65L60,

1 Introduction

The elliptic interface problems with discontinuous coefficients and singular sources can be found in many natural science such as fluid mechanics [38], computational electromagnetics [22, 29, 66, 67], materials science [30, 32] and biological science [10, 19, 63].

The elliptic interface problems have been solved by many numerical techniques for example classic finite element method [1, 4, 6, 11, 23, 31, 51], improved interface method [3, 13, 39, 47, 61, 60, 62, 64, 66, 68], mixed finite element method [5], discontinuous Galerkin finite element methods

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