The CCVMLS approximation and the envelop method

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Abstract

The successful application of the complex variable method in solving mechanical problems can be traced back to the contribution in 1909 by G.V. Kolosov. In 2004, the complex variable method was introduced into the moving least-squares (MLS) approximation to improve its computational efficiency by Li at first time, resulting in the so-called complex variable moving least-squares (CVMLS) approximation. Based on more accurate definition of error norm function in CVMLS approximation, Ren proposed the improved complex variable moving least-squares (ICVMLS) approximation with greatly enhanced accuracy in 2010. Then, Bai defined a new edition of ICVMLS approximation by using conjugate basis functions. For the convenience of description, the methods developed by Ren and Bai are called ICVMLS(I) and ICVMLS(II) hereinafter, respectively. Recently, by considering an conjugate form approximation of the field variables, the conjugate complex variable moving least-square (CCVMLS) approximation was proposed by D.M. Li. Combined the CCVMLS approximation with the Galerkin weak form of the control equations, the conjugate complex variable element-free Galerkin (CCVEFG) method was developed and successfully applied to two-dimensional elasticity and steady state heat conduction problems. The computational performance of the CVMLS approximation, ICVMLS(I) approximation, ICVMLS(II) approximation and CCVMLS approximation are evaluated both on numerical accuracy and efficiency simultaneously, by a newly developed envelop method.

Keywords: conjugate complex variable moving least-square (CCVMLS) approximation; conjugate complex variable element-free Galerkin (CCVEFG) method; envelop method; elasticity; steady state heat conduction

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