Accepted Manuscript

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PII: S0045-7825(16)30275-4
DOI: http://dx.doi.org/10.1016/j.cma.2016.09.008
Reference: CMA 11120

To appear in: *Comput. Methods Appl. Mech. Engrg.*

Received date: 27 April 2016
Revised date: 28 August 2016
Accepted date: 12 September 2016

Please cite this article as: M. Dehghan, M. Abbaszadeh, Proper orthogonal decomposition variational multiscale element free Galerkin (POD-VMEFG) meshless method for solving incompressible Navier-Stokes equation, *Comput. Methods Appl. Mech. Engrg.* (2016), http://dx.doi.org/10.1016/j.cma.2016.09.008

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September 22, 2016

Abstract

Recently, because of simplicity of meshless methods, they have been employed for solving many partial differential equations. One of the meshless methods is element free Galerkin technique. The element free Galerkin is very similar to the finite element method with this difference that the test and trial spaces of EFG procedure are shape functions of moving least squares approximation. Using the mentioned shape functions, solving a problem on a complex domain is very simple. Some researchers proposed several modifications and enriched approaches for improving the element free Galerkin method that one of them is variational multiscale element free Galerkin procedure. Up to the best of authors' knowledge, the element free Galerkin method based on the shape functions of moving least squares approximation needs more CPU time than the element free Galerkin method based on the shape functions of moving Kriging interpolation. Thus, in the current paper, we employ the variational multiscale element free Galerkin based on the shape functions of moving Kriging interpolation. Also, for reducing the CPU time of the presented numerical scheme, we use the proper orthogonal decomposition (POD) approach. Therefore, in the current paper, we propose the proper orthogonal decomposition variational multiscale element free Galerkin (POD-VMEFG) method for solving time-dependent incompressible Navier-Stokes equation. Moreover, several test problems are given that show the acceptable accuracy and efficiency of the proposed scheme.

Keywords: Meshless methods, Variational multiscale element free Galerkin meshless method, Proper orthogonal decomposition method, incompressible Navier-Stokes equation.

AMS subject classification: 65L60, 65M60, 65N30, .

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