Virtual Elements for the Reissner-Mindlin plate

C. Chinosi†

† Dipartimento di Scienze e Innovazione Tecnologica (DISIT)
Università del Piemonte Orientale
Viale Teresa Michel,11-15121 Alessandria, Italy
e-mail: claudia.chinosi@uniupo.it, web page: https://upobook.uniupo.it/claudia.chinosi

ABSTRACT

The Virtual Element Methods (VEM) have been introduced very recently (see [1]) as an extension of Finite Element Methods to general polygonal and polyhedral elements. The interest in numerical methods that can make use of general polytopal meshes has recently grown in the mathematical and engineering literature due to the great advantages related to the use of general grids, such as high flexibility in mesh generation and robustness to distortion. The key idea of VEM is that the local discretization spaces contain all the polynomial up to a given degree plus some additional non-polynomial function that do not need to be known in detail but only through their degrees of freedom. Thanks to this features VEM can easily handle general polygons and polyhedrons without complex integrations on the elements. The Virtual Element Method has been applied successfully in a large range of problems (see for instance [3] and the references therein). In particular it has been applied for the approximation of the plate bending problem in the Kirchhoff-Love formulation (see [4], [5]). In this work we present a virtual element method for the plate bending problem in the Reissner-Mindlin formulation. It is known that the approximation of this problem is not straightforward due to the so called locking phenomenon when the thickness of the plate is small with respect to the other dimensions of the plate. One of the most popular strategies developed in Finite Element Methods context to overcome this phenomenon is the *mixed interpolation of tensorial components* (MITC) technique, (see [2]). Here we introduce a virtual element method for Reissner-Mindlin plates that follows the MITC approach. We present a family of VEM discretization spaces that will depend on one parameter related to the degree of accuracy. The theoretical results assure that the introduced elements are locking-free and imply convergence with optimal rate in the H^1-norm, uniformly in the thickness. In order to assess the convergence properties of the scheme some numerical tests on different families of meshes has been performed. The obtained results confirm the theoretical predictions.

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