The state of the art for mesh coupling at nonconforming interfaces is presented and reviewed. Mesh coupling is frequently applied to dealing with motion in electromagnetic actuators [1, 2, 3]. The focus of the contribution is on lowest order Whitney elements. Both interpolation- and projection-based methods are considered [4]. In addition to accuracy and efficiency, we emphasize the question whether the schemes preserve the structure of de Rham complex, which underlies Maxwell’s equations.

Projection methods require the inversion of a mass matrix. This can be done efficiently by using biorthogonal bases for the Lagrange multiplier space [3, 5], resulting in a diagonal mass matrix. Nevertheless, projection methods are demanding to implement since discontinuous functions have to be numerically integrated. Strategies to cope with this are presented in [6, Fig. 9], [7] and [8, Sect. 3].

The generalization of projection based methods from nodal to edge elements is not obvious. In particular, only a few references aim at a rigorous theoretical analysis of such mortar element methods [9, 10]. Many authors again use the edge element space as the Lagrange multiplier space, e.g. [2, 6, 11]. Unfortunately, this policy does not yield a structure preserving discretization. As a new contribution, a projection method is presented, in which mortar spaces are chosen from the Buffa-Christiansen complex [12]. This approach is structure preserving. Its performance is compared with a straightforward interpolation based on Whitney and de Rham maps.

REFERENCES


Disclaimer: This paper is based on [13]. Similar work was presented at the 16th IEEE Conference on Electromagnetic Field Computation CEFC 2014, and at the 12th Söllerhaus Workshop Fast BEM in Industrial Applications 2014.