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Energy-momentum Preserving Time Integration Schemes for Petrov-Galerkin EAS Mixed Finite Elements

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In order to improve the performance of finite elements in distorted meshes, Rajendran and Liew [3] proposed a Petrov-Galerkin ansatz for higher order displacement based finite elements. Recently, this approach has been extended to mixed finite elements by Pfefferkorn and Betsch [2] which allows the construction of high performance low-order finite elements which are mesh-distortion insensitive, locking free and do not suffer from spurious hourglassing instabilities in large deformation problems.

So far, this class of Petrov-Galerkin elements has, to the best knowledge of the authors, only been used for static problems. However, their high performance in that case suggest improved performance also in dynamic simulations especially in combination with energy-momentum preserving time integration schemes (see [1, 4]). In the present contribution we investigate Petrov-Galerkin mixed finite elements in dynamic structure preserving simulations and present issues as well as corresponding solutions to problems which arise from the underlying Petrov-Galerkin framework.

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