A NEW APPROACH TO MIXED METHODS FOR REISSNER-MINDLIN PLATES AND SHELLS

WALTER ZULEHNER

Abstract. A mixed method for Reissner-Mindlin plate/shell models is presented with the displacement, the bending moment, and the shear strain as unknowns. This mixed formulation is equivalent to the original primal formulation without additional regularity assumptions. For vanishing thickness the Kirchhoff-Love plate/shell model is recovered with the same function spaces for the displacement and the bending moment as for the Reissner-Mindlin model. The approach is related to some of the models presented in [1] and [2], where the displacement and a shear (or difference) vector are the unknowns. The resulting schemes proved to be free of transverse shear locking.

The practical implementation of the method is based on a Helmholtz-like decomposition of the bending moment, which allows the use of trial and test functions which are continuous but not necessarily continuously differentiable for discretization.

For the special case of plate models the approach leads to a partially decoupled system of second-order problems for which efficient solution strategies are available. This feature of the new approach was already observed in [3] for the Kirchhoff plate model.

Keywords: Reissner-Mindlin plates and shells, mixed methods, bending moment

Mathematics Subject Classifications (2010): 65N30, 65N22, 74K20

References

[1] Q. Long, P.B. Bornemann and F. Cirak. Shear-flexible subdivision shells. *Int. J. Numer. Methods Eng.*, 90(13), 1549-1577, 2012.

[2] R. Echter, B. Oesterle and M. Bischoff. A hierarchic family of isogeometric shell finite elements. *Computer Methods in Applied Mechanics and Engineering*, 254:170180, 2013.

[3] K. Rafetseder and W. Zulehner. A decomposition result for Kirchhoff plate bending problems and a new discretization approach. SIAM *Journal on Numerical Analysis*, 56(3):19611986, 2018.

Institute of Computational Mathematics, Johannes Kepler University Linz, Austria
E-mail address: zulehner@numa.uni-linz.ac.at