

A unified approach for mixed formulations of elliptic problems with applications in structural mechanics

Walter Zulehner* and Dirk Pauly†

A general and flexible approach will be presented how to derive mixed variational formulations of elliptic problems. The approach is based on the concept of densely defined linear operators and their adjoints, rather than on the well-known technique of integration by parts, which is typically used for the construction of mixed variational formulations otherwise. The construction of the mixed formulation starts with the primal variational formulation rather than the strong (or classical) form of the problem. This allows to address the relation between the primal and the mixed problem quite thoroughly and typically ensures the equivalence of the two problems without additional regularity assumptions.

As applications of the approach we will discuss known and new mixed formulations of Hellinger-Reissner type. As a particular application the Reissner-Mindlin plate bending model is discussed, for which a decomposition of the problem into three simpler second-order problems is shown.

*Institute of Computational Mathematics, Johannes Kepler University Linz, Linz, Austria, zulehner@numa.uni-linz.ac.at

†Fakultät für Mathematik, Universität Duisburg-Essen, Essen, Germany, dirk.pauly@uni-due.de