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Extended Polar Decompositions for Finite Plane Strain

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The concept of unsheared triads of material line elements in a body was introduced by Boulanger & Hayes (2001) who showed that there is a link between these triads and new decompositions of the deformation gradient, generalizing the classical polar decomposition. Associated with any unsheared (oblique) triad of material line elements is a new decomposition. Because there is an infinity of unsheared triads, there is an infinity of such decompositions, called “extended polar decompositions”. In the present paper attention is confined to finite plane strain so that the deformation gradient is essentially two-dimensional. The typical unsheared triad consists of a pair of unsheared material line elements in the strain plane and an element normal to that plane. As such a triad is varied it is seen how the decomposition also changes. In particular, for simple shear, the whole range of extended polar decompositions is presented.

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