

**ON THE LIMITING OF GRADIENTS AND THE FINITE VOLUME DISCRETIZATION
OF DIFFUSION FLUXES ON UNSTRUCTURED CO-LOCATED GRIDS**

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ABSTRACT

The finite volume discretization of diffusion fluxes on co-located grids requires the cell-face as well as the cell-centre gradients. In this study, the derivation of the cell-face gradient formulae is revisited in order to arrive at generalised expression, applicable to conjugate heat transfer problems. Three cell-face gradient expressions, namely the vertex-based, the standard (over-relaxed) and enhanced one are then assessed in terms of the accuracy and convergence properties. All tested expressions deliver similar results while the standard expression is numerically most stable. In addition, a new limiting procedure is proposed for the cell-face and cell-centre gradients to further enhance the numerical oscillations removal and achieve favourable convergence rates. The effectiveness of this procedure in association with the analyzed cell-face gradient expressions is demonstrated for all test cases.