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The kinematics of the reduced velocity gradient tensor in a fully developed turbulent free shear flow OLIVER BUXTON, ANDREW WYNN, PAIGE RABEY, Imperial College London — The reduced velocity gradient tensor (VGT) is defined as a 2×2 block, from a single interrogation plane, of the full VGT, $\partial u_i/\partial x_j$. Direct numerical simulation data from the fully developed turbulent region of a nominally two-dimensional mixing layer is used in order to examine the extent to which information on the full VGT can be derived from the reduced VGT. It is shown that the reduced VGT is able to reveal significantly more information about regions of the flow in which strain-rate is dominant over rotation. It is thus possible to use the assumptions of homogeneity and local isotropy to place bounds on the first two statistical moments of the eigenvalues of the reduced strain-rate tensor (symmetric part of the reduced VGT), which in turn relate to the turbulent strain-rates. These bounds are shown to be dependent upon the kurtosis of $\partial u_1/\partial x_1$ and another variable defined from the constituents of the reduced VGT. The kurtosis is observed to be minimised on the centreline of the mixing layer and thus tighter bounds are are possible at the centre of the mixing layer than the periphery. Nevertheless, these bounds are observed to hold for the entirety of the mixing layer, despite some significant departures from local isotropy.

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