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Effective axial diffusivities for wavy vortex flow from numerical particle tracking: dependence on radius ratio and flow state GREGORY P. KING, Univerisity of Warwick, MURRAY RUDMAN, CSIRO Manufacturing and Infrastructure Technology, KATIE COUGHLIN, Lawrence Livermore National Laboratory, GEORGE ROWLANDS, University of Warwick — The mixing characteristics of wavy Taylor vortex flow have been studied. In a previous work [Rudman, *AIChE J.*, **44**, 1998) we demonstrated that inter-vortex mixing could be modelled as a one-dimensional diffusion process along the length (z) of the cylinders and determined, through particle tracking experiments in numerical fields, that the (non-dimensional) effective axial diffusion coefficient (D_z) is a non-monotonic function of the Reynolds number. In a subsequent work (*Phys. Fluids*, **13** 2001) we showed that D_z correlated with the product of space-averaged Eulerian symmetry measures – quantities that measure the deviation from two-dimensional flow. Those results were for one radius ratio ($\eta = 0.875$) and one particular wavy vortex flow state (six waves, axial wavelength = 2.33 gap widths). To determine if this result was 'coincidental', we have carried out an extensive investigation of the dependence of D_z on Reynolds number, radius ratio and flow state. We find that the excellent correlation of the original study deteriorates only modestly when the radius ratio is decreased from 0.875 to 0.700. On the other hand, D_z shows a more interesting dependence on flow state.

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