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Methodologies for solving Vortex Wave Interaction problems to obtain edge states ANDREA ISONI, Imperial College London, HUGH BLACKBURN, Monash University, PHILIP HALL, SPENCER SHERWIN, Imperial College London — The interaction of waves with streamwise vortices (Vortex Wave Interaction Theory or VWI Theory) is relevant in motivating the "self-sustained processes" and in delineating perturbations to shear flows which may become either laminar or turbulent. It has been recognised that a streamwise vortex velocity field (U,V,W) can be decomposed into an O(1) axial U-component, "streak" field, and a O($R^{-1}*$) roll field (V,W). As identified by Hall and Smith 1991, an equilibrium solution can be produced by an interaction of the non-linear wave terms with the roll field within the critical layer. VWI theory has been investigated numerically on a Couette flow using three different approaches, which we refer to as asymptotic, regularised and hybrid methods. In the first approach, the roll equations are subjected to jump conditions along the critical layer as proposed by Hall and Smith 1991. In the second approach, a body forcing, which regularises the jump conditions, is added on the roll equations as discussed in Hall and Sherwin 2010. In the third approach, a forcing term proportional to the divergence of the Wave Reynolds Stresses is imposed on the roll equations. In this presentation we will discuss the merits of each of these approaches and the connection with the lower branch solution.

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