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Instability in turbulent stratified channel flow[1] LENNON Ó NÁRAIGH, OMAR MATAR, PETER SPELT, TAMER ZAKI, Imperial College London — We determine the stability properties of a deformable interface separating a fully-developed turbulent gas flow in a channel from a thin laminar liquid layer. To do this, we derive a linear model to describe the interactions between the turbulent gas flow and the interfacial waves. This model involves two steps. First, we derive a flat-interface base-state velocity. This takes account of the laminar sublayer present in the near-interfacial region of the gas, and provides a way of determining the wall and interfacial shear stresses as a function of the applied pressure gradient. Next, we perform an Orr-Sommerfeld analysis on the Reynolds-averaged Navier-Stokes equations. This necessitates the selection of a turbulent-stress closure scheme. This approach gives the growth rate of the wave amplitude, as a function of the relevant dimensionless system parameters and turbulence closure relations. It also extends previous work by accounting for the effects of the thin liquid layer on the dynamics.

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