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The Trailing Edge Problem for Mixed Convection Flow Past a Horizontal Plate

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The influence of buoyancy onto the boundary-layer flow past a horizontal plate aligned parallel to a uniform free stream is characterized by the buoyancy parameter $K = \mathrm{Gr}/\mathrm{Re}^{5/2}$ where Gr and Re are the Grasshof number and the Reynolds number, respectively. An asymptotic analysis of the complete flow field including potential flow, boundary layer, wake and interaction region near the trailing edge will be given for small buoyancy parameters and large Reynolds numbers in the distinguished limit $K\mathrm{Re}^{1/8} = \mathrm{O}(1)$. The focus will be the numerical solution of the interaction problem at trailing edge. The interaction law is given by $p = K\,\mathrm{Re}^{1/8}A\ - \frac{1}{\pi}\int_{-\infty}^{\infty}\frac{A'(\xi)}{\xi - x}\,\mathrm{d}\xi$, where the first term takes the buoyancy effects into account. The solution will be discussed and analogies and differences to the interaction problem of a plate with a small angle of attack in an uniform free stream will be pointed out.

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