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Long Layers Exhibiting Local Jumps, in Industrial and Biomedical Applications

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In various interesting flow configurations, the long-scale thin layer problem interacts with the local property-jumping problem. First is that of modelling ground effect for cars. In two or three dimensions the boundary layer system over the scale of the car body and wake cannot be solved without the short-scale leading edge quasi-jump, and vice-versa. The second setting concerns modelling of multi-blade-and-wake behaviour for rotor performance. The short-scale response is again centred on the leading edge, while the long-scale response has interactive boundary layer form but (unusually) over the entire blade and wake. Third is branching flows, with application to cardiovascular, respiratory, cranial branchings and networks. Short-long analysis agrees with direct simulations. Recent developments (with Bowles, Dennis, Jones, Ovenden, Purvis, Tadjfar, J Engineering Mathematics, J Fluid Mechanics, 2001-2003) will be described throughout.

View the extended summary