

## **Long layers exhibiting local jumps, in industrial and biomedical applications**

Frank T Smith  
Mathematics Department  
University College London  
UK

Various interesting flow configurations, with applications in industry and biomedicine, are found to involve long-scale layers interacting with local property-jumping behaviours. At least three examples of these will be described, relating to ground effects, to multiple blades with wakes and to branching networks. The very latest developments will provide the focus of the presentation and these all concern computation hand in hand with theory / analysis.

Regarding somewhat more detail, as the submitted abstract essentially stated, in various interesting flow configurations, the long-scale thin layer problem interacts with the local property-jumping problem. A first example 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 special application to cardiovascular, respiratory, cranial branchings and networks. Short-long analysis agrees with direct simulations. Recent developments, which involve papers that have recently appeared or are shortly to appear with Bowles, Dennis, Jones, Oviden, Purvis, Tadjfar, in *J Engineering Mathematics*, *J Fluid Mechanics*, 2001-2003, will be described throughout.