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### **Challenging Issues in Separated and Complex Turbulent Flows**

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#### **ABSTRACT**

Challenging issues on separated flows at high Reynolds numbers are discussed for several prototype flows: separated-and-reattaching flows; separated flows around cylindrical bluff bodies; separated flows around axisymmetric and plane-symmetric bluff bodies. These flows are characterized by large-scale vortices which interact with each other or with a solid surface. Structure and dynamics of the large-scale vortices are discussed, together with the low-frequency modulation of the vortices whose time scale is an order of magnitude greater than the vortex-shedding period. It is argued that the modulation is an intrinsic property of the separated flows. The advent of computers and laser-applied technology have been making it more and more efficient and economical to obtain spatio-temporal structure of vortices in the separated flow. What is lacking is a physical model which predict essential properties of the separated flows such as the base pressure. This is because the base pressure is determined by the overall dynamics of the near wake flows. A strategy of interactive control of unsteady separated flows which assumes the existence of a precursor of large-scale separation is also discussed.