

## **Experiments on Some Separated Flows**

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### **Brief Biographical Sketch**

Dr. Alakesh Chandra Mandal is a Professor in the Department of Aerospace Engineering IIT Kanpur. His research interests are experimental aerodynamics, flow instability and transition and turbulent shear flows.

### **Abstract**

Flow separation is often encountered in various engineering devices. For example, it can occur over an aircraft wing, wind turbine blades, gas turbine blades, surface of a ship, and also in various automobiles. A flow can separate due to adverse pressure gradient or due to a sharp corner. It is usually not desirable as it can adversely affect the aerodynamic performance of a body. However, a separated flow may or may not reattach with the wall. When it reattaches with the wall, it forms an enclosed region called a separation bubble. The transition mechanism in the separated shear layer, knowledge of which may contribute to an effective flow control device, is yet to be adequately understood as it depends on various parameters such as Reynolds number, free-stream turbulence level (FST), adverse pressure gradient, etc. We have carried out an experimental investigation to understand the effects of FST and adverse pressure gradient. Based on our present measurements and the available data in the literature, we propose a criterion that determines whether the shedding frequency of the separated shear layer will remain the same for the cases without and with an enhance level of FST. We also find that the linear stages of transition are not bypassed even at an enhanced level of FST. Further, we find that the vortex shedding associated with the separating shear layer is regular for the case of a low adverse pressure gradient, whereas it is found to be irregular or intermittent for the case of a high adverse pressure gradient. This intermittent nature of the vortex shedding for the high adverse pressure gradient case is found to be due to the low-frequency oscillation of the shear layer and the associated movement of the points of inflection in the velocity profiles. Similar, observation is also made for the flow over an airfoil. An effort has been made to find the origin of this low-frequency oscillation.