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An Experimental Investigation of an Airfoil Traversing Across a Shear Flow[1] BORHAN A. HAMEDANI, AHMED NAGUIB, MANOOCHEHR KOOCHESFAHANI, Michigan State University — While the aerodynamics of an airfoil in a uniform approach flow is well understood, less attention has been paid to airfoils in non-uniform flows. An aircraft encounters such flow, for example, during landing through the air wake of an aircraft carrier. The present work is focused on investigating the fundamental aerodynamics of airfoils in such an environment using canonical flow experiments. To generate a shear approach flow, a shaped honeycomb block is employed in a wind tunnel setup. Direct force measurements are performed on a NACA 0012 airfoil, with an aspect ratio of 1.8, as the airfoil traverses steadily across the shear region. Measurements are conducted at a chord Reynolds number $Re_c \approx 75$k, based on the mean approach stream velocity at the center of the shear zone, for a range of airfoil traverse velocities and angles of attack ($0 - 12$ degree). The results are compared to those obtained for the same airfoil when placed statically at different points along the traverse path inside the shear zone. The comparison enables examination of the applicability of quasi-steady analysis in computing the forces on the moving airfoil.

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