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Unsteady Structure of Three-Dimensional Stall Cells[1] KEVIN DISOTELL[2], JAMES GREGORY[3], The Ohio State University — A description of three-dimensional flow separation encountered on wings operating just above their maximum lift condition remains a critical link toward increased payload capability for air vehicles. In particular, the development of spanwise-periodic separation zones or "stall cells" observed in the surface streamline pattern appear to result from the amplification of a spanwise instability in the separated shear layer for certain stall types. Time-averaged point measurements and steady simulations have largely been used to characterize the geometry of stall cells, although unsteady motion due to possible shear layer flapping has been reported by Yon and Katz (1998). Details of the flow topology remain unclear especially under turbulent flow conditions. The development of stall cells on a rectangular NACA 0015 airfoil of aspect ratio 2.5 at chord Reynolds numbers above 750,000 is investigated in the current work using planar, time-resolved particle image velocimetry measurements. Flow visualization with miniature surface tufts and high-speed imaging revealed intermittent cellular patterns at incipient stall conditions which are explored further. Understanding the behavior of cellular separation can help inform flow control strategies aimed at mitigating stall.

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