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Linear Modal Instabilities on Swept Finite-Aspect Ratio Wings at Low Reynolds Numbers and High Angles of Attack[1] ANTON BURTSEV, WEI HE, VASSILIOS THEOFILIS, University of Liverpool, MICHAEL AMITAY, Rensselaer Polytechnic Institute, KUNIHIKO TAIRA, University of Califronia, Los Angeles — Low Reynolds number separated laminar flow over finite swept wings is investigated numerically for a range of sweep angles (Λ) and aspect ratios (AR) at high angles of attack (α). Modal TriGlobal stability analysis, POD and SPOD analyses of the 3-D flows are performed. Global stability analysis is performed on selected cases in order to identify the mechanisms leading to the formation of linear global mode. POD and SPOD are carried out in the nonlinear regime to classify the dominant structures and corresponding individual frequencies of the separated flow and assess the effects of geometrical parameters. Several distinct modes are identified in the separated flow. First, the Kelvin-Helmholtz mode dominates the low-α flow similar to previous studies. As α increases, the flow exhibits more complex 3-D behaviour associated with the Interaction Mode (IM), which is affected by the sweep angle. At high-Λ, the dominant mode takes the form of streamwise vortices for the larger $AR = 4$ wing, while on the $AR = 2$ wing the tip effect leads to the dominant mode being a tip instability. TriGlobal analysis reveals that the unstable wake is caused by an amplified global mode close to the symmetry plane similar to previous work on the elliptic wing.

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