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Ground effects on the stability of separated flow around an airfoil at low Reynolds numbers[1] WEI HE, The Hong Kong University of Science and Technology, PENG YU, Southern University of Science and Technology, LARRY K. B. LI, The Hong Kong University of Science and Technology — We perform a BiGlobal stability analysis on the separated flow around a NACA 4415 airfoil at low Reynolds numbers ($Re = 300 - 1000$) and a high angle of attack $\alpha = 20^\circ$ with a focus on the effect of the airfoil's proximity to a moving ground. The results show that the most dominant perturbation is the Kelvin–Helmholtz mode and that this traveling mode becomes less unstable as the airfoil approaches the ground, although this stabilizing effect diminishes with increasing Reynolds number. By performing a Floquet analysis, we find that this ground effect can also stabilize secondary instabilities. This numerical–theoretical study shows that the ground can have a significant influence on the stability of separated flow around an airfoil at low Reynolds numbers, which could have implications for the design of micro aerial vehicles and for the understanding of natural flyers such as insects and birds.

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