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Airborne Wind Energy Based on Dual Airfoils

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The Airborne Wind Energy paradigm proposes to generate energy by flying a tethered airfoil across the wind flow at a high velocity. While Airborne Wind Energy enables flight in higher-altitude, stronger wind layers, the extra drag generated by the tether motion imposes a significant limit to the overall system efficiency. To address this issue, two airfoils with a shared tether can reduce overall system drag. While this technique may improve the efficiency of AWE systems, such improvement can only be achieved through properly balancing the system trajectories and parameters. That problem can be tackled using optimal control. A generic procedure for modeling multiple-airfoil systems with equations of minimal complexity is proposed. A parametric study shows that at small and medium scales, dual-airfoil systems are significantly more efficient than single airfoil systems, but they are less advantageous at very large scales.