

# AN INVESTIGATION ON THE STABILITY OF DYNAMIC SOARING ORBITS

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## Abstract

Dynamic soaring is a technique for extending flight times by utilising wind gradients. It was originally observed amongst birds like albatrosses and has huge potential for high-endurance UAV flights. In this paper, we investigate the stability of dynamic soaring orbits from a linear periodic system perspective and explore the feasibility of using a pole placement method for augmenting stability. Stability of dynamic soaring orbits is vital since the trajectories can get disturbed by a gust or crosswinds, causing the UAV to veer off-course. An open-loop stable orbit can reduce the control effort and power requirement. Variation of Phugoid damping values with wind shear has been studied for a qualitative appreciation of the stability of dynamic soaring orbits. For assessing the dependence of the stability of dynamic soaring orbits on wind shear, a Monte-Carlo based approach is used.

**Keywords:** Dynamic Soaring, Stability of Periodic Systems, Floquet Theory, Stability Augmentation