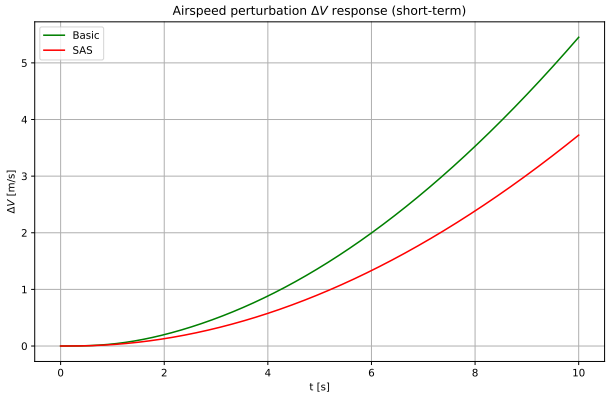
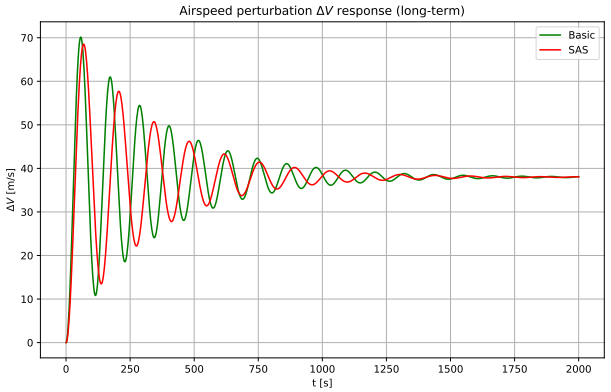
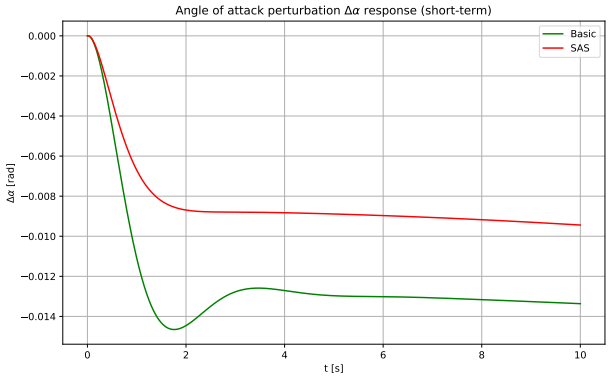
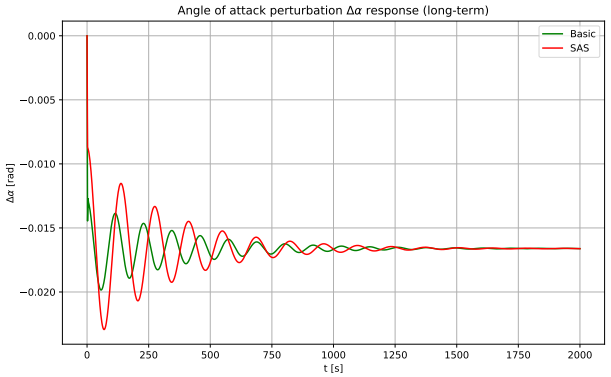
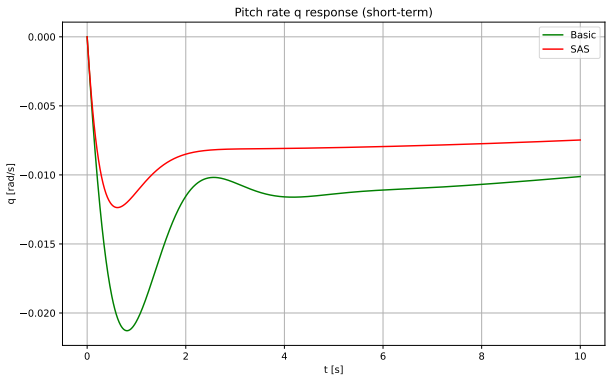
Longitudinal response to 1° elevator deflection, basic vs SAS

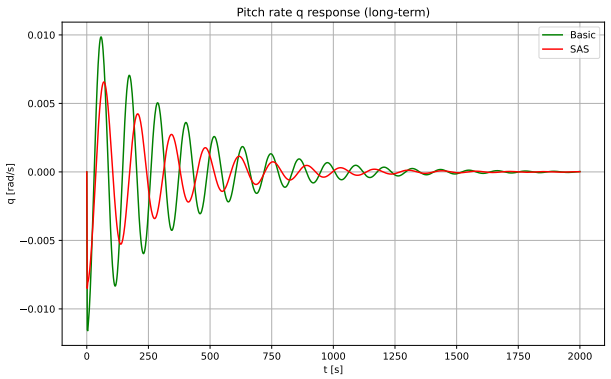












The Stability Augmentation System (SAS) is designed to double the short-period damping. This damping mainly depends on the stability derivatives c_{m_q} and $c_{m_{\dot{\alpha}}}$. Since c_{m_q} is significantly larger in magnitude and q is a state variable (unlike $\dot{\alpha}$), the SAS acts on c_{m_q}. Specifically, the pitch rate q is fed back through an elevator deflection δ_e. The SAS gain, k, was determined by analyzing the variation of the real part of the short-period eigenvalues as a function of k, selecting the value that doubles the real part (and consequently the damping).
In the first few seconds after the elevator deflection, the responses of $\Delta\alpha$ and q clearly show the increased short-period damping achieved by the SAS. Over longer time intervals, all state variables exhibit weakly damped oscillations characteristic of the phugoid mode. Indirectly, the SAS also slightly increases the phugoid damping, allowing the steady state to be reached more rapidly.