

## Numerical Solving Method for Specific Dynamic Performance of Unstable Flight Dynamics with PD Attitude Control

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**Abstract :** In the realm of flight control, the Proportional- Derivative (PD) control is still widely used for the attitude control in practice, particularly for the pitch control, and the attitude dynamics using PD controller should be investigated deeply. According to the empirical knowledge about the unstable flight dynamics, the control parameter combination conditions to generate sole or finite number of closed-loop oscillations, which is a quite smooth response and is more preferred by practitioners, are presented in analytical or numerical manners. To analyze the effects of the combination conditions of the control parameters, the roots of several polynomials are sought to obtain feasible solutions. These conditions can also be plotted in a 2-D plane which makes the conditions be more explicit by using multiple interval operations. Finally, numerical examples are used to validate the proposed methods and some comparisons are also performed.

**Keywords :** attitude control, dynamic performance, numerical solving method, interval, unstable flight dynamics

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