

# Mode Switching Algorithm to Improve Variable-Pitch-Propeller Thrust Generation for Drones Under Motor Current Limitation

Yuto Naoki, Sakahisa Nagai, Hiroshi Fujimoto,

***Abstract***—Research and development are active in multirotor drones. Attention has been focused on improving drone mobility performance by introducing variable pitch propellers. However, previous studies have not considered main motor currents in their controller design. The aim of this study is to improve thrust response by controlling the variable pitch propeller in the thrust dimension while keeping steady-state efficiency. Feed-forward control of thrust by switching modes using maximum current was designed. The control is designed to switch between a thrust reaching mode that uses pitch angle and rotational speed and a efficiency optimizing mode. The mode switching transitions were verified by simulation, and the effectiveness of the proposal was experimentally validated.

***Index Terms***—variable pitch propeller, mode switching control, thrust control, current saturation.