Online Learning of Control Effectiveness Model for Transition Aircraft

The development of novel aircraft configurations that combine hover and wing-borne flight and that are in many cases over-actuated and input nonaffine lead to new challenges in controller design. A control technique that has recently received increasing attention and that provides robustness in the presence of model uncertainties is incremental nonlinear dynamic inversion. This approach, however, relies on a reasonably well-known control effectiveness model. Depending on the configuration and coupling between actuators this control effectiveness model can be difficult to obtain and may change in the case of actuator failures. State-of-the-art methods from system identification and adaptive control or machine learning architectures could provide an effective method to learn and adapt a control effectiveness model online.

Goals:
• Literature review of incremental control, control allocation and system identification methods
• Creation of a simulation environment for evaluation purposes (based on an existing simulation at the iFR)
• Development and evaluation of an online learning approach for the control effectiveness of a transition aircraft

Requirements:
• Experience with system identification methods is beneficial
• Understanding of flight mechanics / dynamical systems
• Programming experience with Python and Matlab/Simulink is beneficial
• Experience in machine learning / neural networks is beneficial
• Good academic performance

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