Robust Lateral Control of Future Small Aircraft

It is a well-known fact that the General Aviation (GA) sector exhibits a significant higher accident rate compared to common transport aircraft (airliners). This is caused by two major reasons: First, pilots of General Aviation Aircrafts commonly show a relatively low training level and a small number of flight hours compared to airliner (ATPL) pilots. Thus, their flight experience and hazard awareness is in general strictly limited. Second, General Aviation Aircraft usually are not equipped with various well-proven safety enhancing assistance systems like an active Fly-by-Wire Flight Control System (FbW FCS), as it is state of the art in current transport aircraft. The use of active FbW FCS supports the pilot by providing excellent Flying and Handling Qualities and thus, reducing pilot's workload at the same time by directly generating appropriate control deflections, dependent on the pilot's commands and (measured) flight condition. Unfortunately, this valuable safety increasing systems did not find their way into the General Aviation sector, due to the tremendous costs of typical Fly-by-Wire control technology. The continuation of the project "Future Small Aircraft (FSA)" at the Institute of Flight System Dynamics of the Technische Universität München comprises the development of active FbW FCS with the primary objective to provide excellent Flying and Handling Qualities to yield best possible pilot's assistance for General Aviation Aircraft. In this paper, the development process of robust lateral flight control algorithms and the proof of robustness, both perfectly tailored to the specific needs of manufacturers of small and medium-sized planes, are presented. The robustness proof is mandatory for GA aircraft due to the present considerable model uncertainty owing to the lower affordable modeling efforts.