

Application of Optimization-based Worst Case Analysis to Control Law Assessment in Aerospace

The flight control law design assessment problem can be formulated as a robustness analysis problem, where a set of suitably defined assessment criteria must be checked to lie within certain limits for all admissible variations of vehicle parameters, external inputs and all flight conditions. Optimization based worst case analysis can be used to find those parameters/inputs/flight conditions for which the criteria are violated or poorly satisfied. The potential of this approach is its general applicability to any kind of simulation models and scenarios including complex non-linearity in control laws. But in order to confidently assert that no violation of assessment criteria exists, a global optimization problem has to be solved. Especially in case of many assessment criteria, global worst case search can lead to a huge computational effort. However, solving worst case problems as a multi-objective problem can help to reduce the number of computations since all or some of the assessment criteria can be considered simultaneously. Optimization-based approaches can also be used to detect parameter sensitivities on the assessment criteria and can help to find safe parameter regions.