Dynamical System Verification through (Inexact) Nonlinear Optimization

Dr Torbjørn Cunis

IFR, University of Stuttgart

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Abstract:

Modern aircraft and their components must fulfill strong requirements on safety and reliability. Today, these are verified in high-fidelity simulations but, no matter how extensive, no simulation will be able to cover all possible test cases. The growing complexity of aeronautical applications, in particular for flight control, will require more sophisticated verification methods to mitigate the increasing cost of numerical simulations.

In my talk I am going to illustrate how methods from dynamical systems theory and nonlinear optimization can be used alongside formal methods and heuristic simulations for verification of cyber-physical systems. Specifically, I will discuss the duality of reachability and optimal control. This duality allows to analytically compute certificates proving reliability and correctness. I will present and discuss some recent results that illustrate the use of nonlinear optimization for verification of dynamical systems. Moreover, I give perspectives on inexactness in nonlinear optimization and its use to mitigate the computational effort for verification.