Trajectory optimization of supersonic plane for reduced noise impact on populated areas

G. Carrillo[1]

[1]Microflown Technologies, Arnhem, Netherlands

Recently there has been a growing interest in developing quieter supersonic flights. Independently of design efforts to reduce the shockwave fingerprint, the trajectory of the aircraft can be optimized by using weather forecasts to minimize the traveling times and control the impact of the sonic booms over dense populated areas. This talk presents a case study for modelling ground noise due to supersonic flights solely based on flight trajectories and weather conditions. Consequently, a trajectory optimization problem was formulated into the optimal control framework to model the noise at ground level. The model couples the dynamics of aircraft with the shockwave propagation models, incorporating forecasted weather conditions and imposes constraints over received shockwave levels on populated areas. A direct multiple-shooting method was employed to solve the resulting boundary value problem and finally, an interior-point method was utilized for the non-linear trajectory optimization problem.

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