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Reduction technologies and prediction of high lift noise

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In the final approach phase airframe noise represents the ultimate aircraft noise barrier for future aircraft when equipped with quiet UHBR engines. This paper presents some of the main dependencies of high-lift noise sources on flow conditions as derived from extensive noise testing at DLR. Some successful reduction technologies for high-lift noise are discussed in view of their influence on the noise generation mechanisms. The remainder of the paper focusses on the numerical prediction of high-lift noise. The prediction concept as implemented in DLR's PIANO code is discussed. It is based on a two step approach, a) the computation of the time averaged turbulent flow field as a result of a CFD(=Computational Fluid Dynamics) simulation and b) the highly accurate CAA (=Computational Aeroacoustics) simulation of perturbations about this mean flow. The prediction relies on an advanced stochastic modelling of the turbulence related sources and thus avoids time consuming turbulence simulations. The method represents an accurate yet "low cost" prediction of high-lift noise. This is particularly important for real applications at flight (very high) Reynolds numbers and corresponding design trade-off studies, which typically require the computation of large numbers of configurations. Examples for such kind of applications are given.