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Recent developments in helicopter rotor noise prediction

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Prediction of discrete frequency noise for rotorcraft in steady flight has reached a high level of sophistication and understanding. The primary challenge in such rotor noise predictions is the accurate determination of the loading on and flow field around the blades. Although current rotor noise prediction tools have been demonstrated for steady flight conditions, the utility of rotorcraft comes from their unique ability to hover and maneuver. Such maneuvers often occur near the ground in close proximity to people. This paper describes an initial study to characterize maneuver noise. A maneuver noise prediction system has been developed, which consists of a flight simulation code, free-vortex wake code, and a maneuver noise prediction code, loosely coupled together. One of the key aspects of this system is the ability to investigate the additional noise caused during the transition from one flight state to another. Several maneuvers including turns, accelerations, and pop-up/popdown maneuvers were considered. Significant increases in the low-frequency noise can occur, depending on how aggressive the maneuver is performed. The status of advanced research on predicting acoustic scattering of the rotor noise by the aircraft and the first-principles prediction of rotor broadband noise will also be presented.