This publication shows advantages and possible applications for variable transmission drivetrains within rotorcraft. The power requirement of a generic helicopter with constant and variable rotor speed was calculated. Various drive train technologies that support a variable transmission were described. The prospects of this technology, its influence on the dynamic behavior of a rotor and further areas that need to be investigated extensively are presented. This technology is applicable to some rotorcraft architecture. Requests from the rotorcraft industry underline the necessity for future rotorcraft using variable rotational speeds. However, the A160 or the EC145 and Mi-8 already show the potential of this technique. Reduction of required power of the rotor should be possible and also an extension of the flight envelope towards higher flight speeds, higher altitudes, better maneuverability, etc. By using a variable transmission gearbox, turbine and auxiliary units can still be driven at their design point, independent of the current rotor speed. Excessive loads may occur when discrete speed transmission are used. Frictional or fluid transmissions with continuous variable ratio may fail due to overheating. Other continuous concepts are favored. The design of a variable speed rotor focuses specifically on its dynamic behaviors and on structural and geometrical optimization to avoid operation at
rotational speed resonance frequencies. Morphing structures may support this. Some rotorcraft architectures can benefit from a variable speed rotor technology. It probably will increase efficiency, decrease noise levels, fuel consumption and CO₂ production, and the flight envelope may be extended.