عنوان مقاله:

Effects of harmonic control and dynamic twist on helicopter rotor performance in forward flight

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خلاصه مقاله:

The optimum rotor blade planform of helicopters required to minimize power, maximize rotor thrust, and maximize lift-to-drag ratio in forward flight, using a numerical optimization approach, is investigated. Here, the traditional approach is modified by Central Composite Design Data (CCD) and a flight dynamic simulation program coupled with a desirability optimization technique implemented in the process of blade optimization. The optimum blade planform parameters (i.e, root chord, taper ratio, taper offset, two-per revolution (۲/rev) harmonic control, and ۲/rev blade dynamic twist) for different gross weights and flight speeds are therefore obtained by this modified procedure. In addition, the main effects and the interaction of all parameters on helicopter performance are assessed. The results of optimization in case ۱ confirm that the appropriate ۲/rev harmonic control and twist of the partially tapered blades improve the helicopter power required by ۲.۶% and lift-to-drag ratio up to about ۲۰% at a baseline gross weight. In case ۲ of optimization, tapering the blade to ۶۰% from ۰.۹R with an appropriately phased ۱/rev and ۲/ rev twist and ۲/rev harmonic control increases the rotor thrust coefficient by ۲۳%, and the lift-to-drag-ratio by about ۱۵%. The helicopter gross weight is declared influence on the thrust increment achieved by the ۲/rev twist and ۲/rev harmonic control. Overall, ۲/rev harmonic control can be incorporated into existing helicopters by a modification of the swashplate and control inputs can be transmitted to the rotor using a fixed outer member with a track linked to a conventional swashplate.

کلمات کلیدی:

Helicopter performance, Blade dynamic twist, Higher Harmonic Control, Desirability approach

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