

헬리콥터 고급이론 과제물 2번

제출기한: 5월 4일 (금)

Problem #1 Consider two tandem (non-overlapping) rotors, each having thrust $T/2$ and disk area A_1 , with total power

$$P_1 = P_{i1} + P_{o1}$$

where P - denotes total power, P_i - denotes induced power and P_o - denotes profile power. Next consider two co-axial rotors, each having thrust $T/2$ and disk area A_2 , with total power

$$P_2 = P_{i2} + P_{o2}$$

Furthermore, assume small vertical separations between the co-axial rotors.

If $P_{o2}/P_{i2} = P_{o1}/P_{i1}$ and $V_{t2} = V_{t1}$

and $\sigma_2 = \sigma_1$, find A_2/A_1 and P_2/P_1 .

Where V_t - is the tip speed and σ is the blade solidity.

Problem #2

- (a) Use the simple energy method to calculate the rotor horsepower required at $\mu = 0.10$; 0.20 ; and 0.3 for the following helicopter in forward flight.

$$\begin{aligned} W &= 3000 \text{ lb} \\ R &= 15 \text{ ft} \\ \sigma &= 0.075 \\ C_{d0} &= 0.012 \\ \Omega R &= 600 \text{ ft/sec} \\ f &= 8 \text{ ft}^2 \text{ (equivalent flat plate area)} \\ \rho &= 0.00238 \text{ slug/ft}^3 \end{aligned}$$

use $\frac{v}{\Omega R} \approx \frac{C_T}{2\mu}$, $\mu \geq 0.1$

and include the radial flow component in the calculation of the profile power.

- (b) Calculate rate of climb at the same μ 's given that the available power is 150% of the hover power required (main rotor).
 (c) Calculate rate of descent (minimum) at same μ 's (power off).
 (d) Calculate rate of descent at the same μ 's given that available power is 50% of hover power required (main rotor). What phenomenon might limit this type of operation?