

ASSIGNMENT 2 HELICOPTERS

Helicopter performance calculations (power curves)

Note

You can work single or in a group of maximum 2 students.

The choice of the helicopter type is from Assignment 1.

Question 1 Determine the power required to hover

1. Calculate the helicopter ideal power.
2. Calculate the helicopter power to hover in ACT theory.
3. Calculate the helicopter power to hover in BEM theory.

Question 2 Determine the power required by the helicopter in forward flight and represent it graphically as a function of velocity (power curve)

4. Calculate the helicopter rotor power in forward flight. For this determine the parasite drag power, induced power and total profile drag power of the rotor.
5. Calculate the tail rotor power using BEM theory (see Note down).
6. Represent the variation of power required as a function of velocity, showing its different components.

Question 3 Determine the speed for maximum endurance and the speed for maximum range

For the helicopter you are considering, determine the speed for maximum endurance and the speed for maximum range. How do these speeds compare to manufacturer performance data? (for example from Jane's All Aircraft).

NOTE

For tailrotor power calculation one can apply the same formulas as for main rotor calculations in BEM theory. Generally, your calculations should arrive at a required tailrotor power in the range of 3-6% of the power required for the main rotor. The only difference is that, using the BEM theory for tailrotor power calculations one should take a factor of 1.1. in the tailrotor induced power which accounts for the vertical fin blockage and the factor $k_{tr}= 1.3 -$

1.5, i.e.: $P_{itr} = 1.1k_{tr}T_{tr}v_{i_{tr}}$.

References

1. Holten, Th. van, "Helicopter Stability, Performance and Control" lecture notes, TU Delft 2002
2. Prouty, R.W., "Helicopter Performance, Stability and Control", Krieger Publishing Company, 1986