Example (From Leishman)

- Gross Weight = 16,000lb
- Main rotor radius = 27 ft
- Tail rotor radius 5.5 ft
- Chord=1.7 ft (main), Tail rotor chord=0.8 ft
- No. of blades =4 (Main rotor), 4 (tail rotor)
- Tip speed= 725 ft/s (main), 685 ft/s (tail)
- K=1.15, Cd0=0.008
- Available HP =3000Transmission losses=10%
- Estimate hover ceiling (as density altitude)

Step I

- Multiply 3000 HP by 550 ft.lb/sec.
- Divide this by 1.10 to account for available power to the two rotors (10% transmission loss).
- We will use dimensional form of power, as shown below:
- $P = \kappa\ Tv + \rho(\Omega R)^3 A\ [\sigma C_{d0}/8]$
- Find an empirical fit for variation of ρ with altitude:

https://www.grc.nasa.gov/www/k-12/rocket/atmos.html

Step 2

- Assume an altitude, h. Compute density, ρ.
- Do the following for main rotor:
  - Find main rotor area A
  - Find v as $[T/(2\rho A)]^{1/2}$ Note T= Vehicle weight in lbf.
  - Insert supplied values of κ, C_{d0}, W to find main rotor P.
  - Divide this power by angular velocity Ω (in radians per second) to get main rotor torque.
  - Divide this by the distance between the two rotor shafts to get tail rotor thrust.
- Now that the tail rotor thrust is known, find tail rotor power in the same way as the main rotor.
- Add main rotor and tail rotor powers. Compare with available power from step 1.
- Increase altitude, until required power = available power.
- Answer = 10,500 ft