1. Show that for a rotor producing constant thrust in non-axial translation moving at a speed of V_0 and, at an angle α, the induced velocity v_i and the ideal power P_i are given by the following equations.

$$\left(\frac{v_i}{v_h}\right)^4 + 2\left(\frac{v_i}{v_h}\right)^3\left(\frac{V_0}{v_h}\right)\sin\alpha + \left(\frac{v_i}{v_h}\right)^2\left(\frac{V_0}{v_h}\right)^2 - 1 = 0$$

$$\frac{P_i}{P_{i,h}} = \left(\frac{V_0}{v_h}\right)\sin\alpha + \left(\frac{v_i}{v_h}\right)$$

2. Show that for a rotor supplied with a constant power in non-axial translation moving at a speed of V_0 and at an angle α, the induced velocity v_i and the thrust produced T are given by the following equations.

$$\left[\left(\frac{v_i}{v_h}\right)^4 + 2\left(\frac{V_0}{v_h}\right)\left(\frac{v_i}{v_h}\right)^3\sin\alpha + \left(\frac{V_0}{v_h}\right)^2\left(\frac{v_i}{v_h}\right)^2\right]\left[\frac{V_0\sin\alpha + v_i}{v_h}\right]^2 - 1 = 0$$

$$\frac{T}{T_h} = \left[\frac{V_0\sin\alpha + v_i}{v_h}\right]^{-1}$$

3. Write a computer program and generate graphs with $\frac{V_0}{v_h}$ and α as the parameters. Vary α and $\frac{V_0}{v_h}$ from 0 to 90 degrees in step of 10 degrees. Keep α as the running parameter on the curves and $\frac{V_0}{v_h}$ as the x-axis. Plot

   (a) $\frac{v_i}{v_h}$ vs. $\frac{V_0}{v_h}$ for constant thrust

   (b) $\frac{P_i}{P_{i,h}}$ vs. $\frac{V_0}{v_h}$ for constant thrust

   (c) $\frac{v_i}{v_h}$ vs. $\frac{V_0}{v_h}$ for constant power

   (d) $\frac{T}{T_h}$vs. $\frac{V_0}{v_h}$ for constant power