DEPARTMENT OF AEROSPACE ENGINEERING

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Helicopter Theory

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1. Using the hub loads and the flap response (up to first harmonic only), developed in the lecture, perform a trim procedure to evaluate the variation of pitch input (collective, cyclic) to main rotor blades, pitch attitude and the inflow ratio with advance ratio (μ= 0, 0.05, 0.1, 0.15, 0.2, 0.3) for the given helicopter data.

Lift-curve slope	2π
Blade profile drag coefficient	0.0079
Fuselage aerodynamic moments	0.0
Density of air	1.225 kg/m^3
Solidity ratio	0.1
Number of blades	4
Lock number	12
Rotating flap-natural frequency	1.1/rev
Equivalent flat plate area	$0.037/\pi$ (Non-dimensionalised w.r.t rotor disk area)
Height of rotor hub above c.g	0.426 (Non-dimensionalised w.r.t rotor radius)
(C.G is directly below the rotor shaft)	
Weight coefficient of helicopter	0.0032

Assume that rotor side force and torque are balanced by tail rotor. Neglecting side force equation and yaw equation, and using the remaining four equilibrium equations, evaluate the control pitch input to the main rotor, the inflow ratio, pitch attitude and flap harmonics for various advance ratio. (Use only first harmonic flap and neglect higher harmonic flap response).

Describe very clearly the procedure followed in obtaining the converged solution.