Problem 1

Using the energy-based approach to generating stability limit diagrams, determine the stability limit \( w_{lim}, \) limiting width of cut, in mm) at spindle speeds of 2500 rpm, 3000 rpm and 3500 rpm. The structure has a stiffness of \( 5\cdot10^5 \) N/m, a damping ratio of 0.05, and a natural frequency of 50 Hz. The process gain is \( K_{pq} = -800 \) N/mm\(^2\). Show your work or the equations used if you use a spreadsheet, including the associated values of \( \omega_c \) (converted to Hz), \( \phi_c \) (converted to degrees) and \( \varepsilon_c \) (converted to degrees) for each speed. **Hint:** Watch your units.