Spm 3 mmH

$$G(S) = \frac{10}{S(S+1)(S+2)}$$

Design a controller that gives the system:
ω_n equal to or larger than ω_n for G(S)
$K_v = 10$ $PM \geq 45°$ $GM \geq 10\,dB$
See python script for bode plot of G(S)

Lead controller

$$D(S)_{Lead} = K \cdot \frac{(S+a)}{(S+b)} \quad a < b$$

High gain at high frequencies not wanted therefore lead instead of lag and PID

Choose a and b two decades apart because optimal Phase is in between(3 rad/s)
$a = 0.3$, $b = 30$, $K = 25$ Trial and error ☺

$$K_v = \lim_{S \to 0} S \cdot D(S) \cdot G(S) = 0.5$$ ← K_v not 10 as pr spec

So we put lag controller $\frac{S+a}{S+b}$ $a > b$

$K_{vtotal} = K_{vlead} \cdot K_{vlag}$ $b = 0.0001$ ← close to DC

$$10 = \frac{a}{b} \cdot 0.5 \Rightarrow a = 20 \cdot b$$
$$= 0.002$$

$$D(S)_{Lag} = \frac{S+0.002}{S+0.0001}$$

Remember bode plot!