

14.05.2020

Vehicle Technology - M4X00394

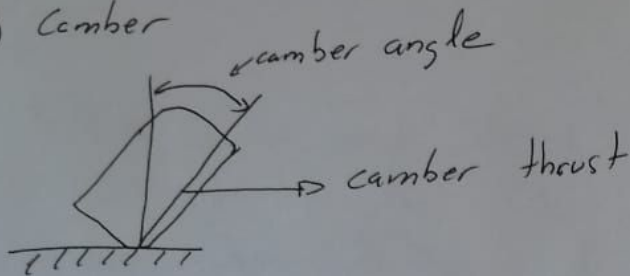
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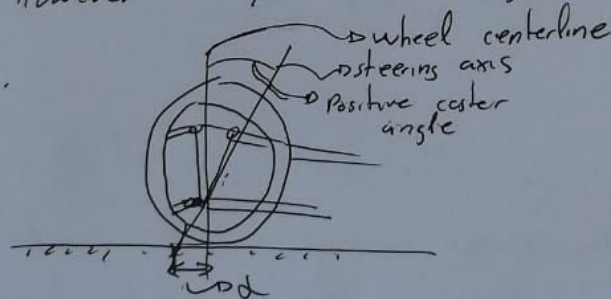
Question 1

i) Camber

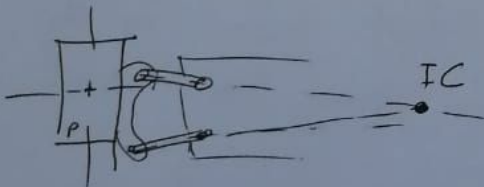


Camber angle creates camber ~~thrust~~ thrust which can increase lateral grip up to a point where reducing contact path lowers overall grip.

ii) Caster angle yields a self centre torque and ~~increases~~ increases ~~stability~~ stability. However it yields a large caster trail making steering heavier.

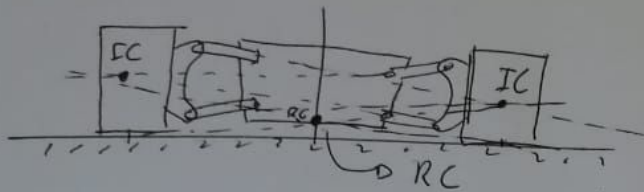


iii) Instant Centre



The instant centre is the point at which the suspension rotates at that instant in time. Effectively the swing arm pivot point. A long swing arm reduces camber change with bump, a short increases it. A high or low IC results in increased scrub.

IV) Roll centre



The roll center is the point at which the chassis rotates at that instant in time. A high RC reduces body roll, but increases jacking forces. A low RC increases body roll but reduces jacking.

Question 2

$$m = 915 \text{ kg}$$

$$r = 130 \text{ m}$$

$$v = 25 \text{ m/s}$$

$$CG = 0.375 \text{ m}$$

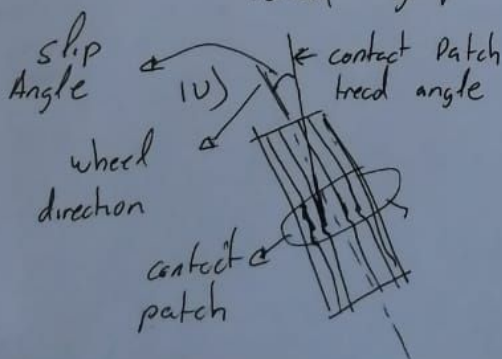
$$1.16 \text{ m}$$

$$2.65 \text{ m}$$

$$i) a = \frac{v^2}{r} = \frac{25^2}{130} = 4.81 \text{ m/s}^2$$

$$ii) w_t = \frac{mah}{t} = \frac{915 \cdot 4.81 \cdot 0.375}{1.16} = 1422.79 \text{ N}$$

iii) Although the outside vertical tyre load increases by the same amount as the inside load reduces, due to the non linear relationship of a tyre between vertical load and lateral grip, not as much grip is increased on the outside wheel as that lost by the inside tyre. This means that the total grip available reduces.



• Slip angle is the angle between the direction in which a wheel is pointing and the direction in which it is actually traveling.

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Question 3

$$M_s = 200 \text{ kg}$$

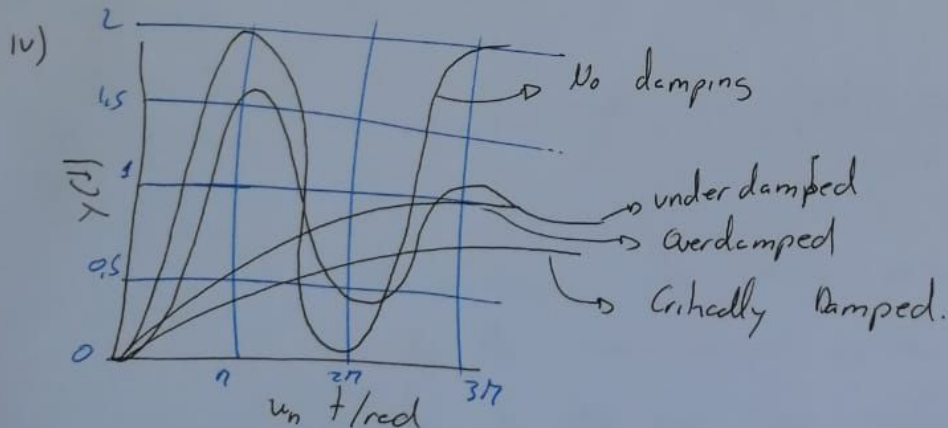
$$k_1 = 13000 \text{ N/m}$$

$$k_2 = 28000 \text{ N/m}$$

$$1) K = 2 \times \left(\frac{1}{\frac{1}{13000} + \frac{1}{28000}} \right) = \cancel{24444.44 \text{ N/m}} = \cancel{24444.44 \text{ N/m}} = 17756.10 \text{ N/m}$$

$$11) f_n = \frac{1}{2\pi} \sqrt{\frac{K}{m}} = \frac{1}{2\pi} \sqrt{\frac{17756.10}{200}} = 1.50 \text{ Hz}$$

iii)



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Question 4

$$m = 875 \text{ kg}$$

$$a = -7.5 \text{ m/s}^2$$

$$w = 100\%$$

$$P_r = 4:1$$

$$M_c = 15.875 \text{ mm}$$

$$S_c = 44.45 \text{ mm}$$

$$N_{sc} = 2$$

$$R_p = 0.15 \text{ m}$$

$$\mu_f = 0.42$$

$$R_r = 0.285 \text{ m}$$

$$1) F = m \cdot a = 875 \cdot 7.5 = 6562.5 \text{ N}$$

$$11) \text{ Force per wheel} = \frac{6562.5}{2} = 3281.25$$

$$\text{Torque required per wheel} = F_w \cdot R = 3281.25 \cdot 0.285 = 935.16 \text{ Nm}$$

$$\text{Slave piston Force} = \frac{T}{\mu \times r} = \frac{935.16}{0.42 \cdot 0.15} = 14843.75 \text{ N}$$

$$\text{Line pressure} = \frac{F_s}{A_s \times n} = \frac{14843.75}{\pi \left(\frac{0.0445}{2} \right)^2 \times 2} = 4782778 \text{ N/m}^2$$

$$\text{Pedal Force} = \frac{p \times A_m}{p_r} = \frac{4782778 \cdot \pi \left(\frac{0.015875}{2} \right)^2}{4} = 228.17 \text{ N}$$