Universidad de Cantabria
Departamento de Ing. Estructural y Mecánica

Capítulo VI

VI.4 Trenes de engranajes

Ejercicios prácticos

Problema 1

El piñón 1 del tren epicicloidal de la figura gira una vuelta a la izquierda y el chasis C un vuelta a la derecha. Hallar las vueltas que giran las ruedas 3 y 2.

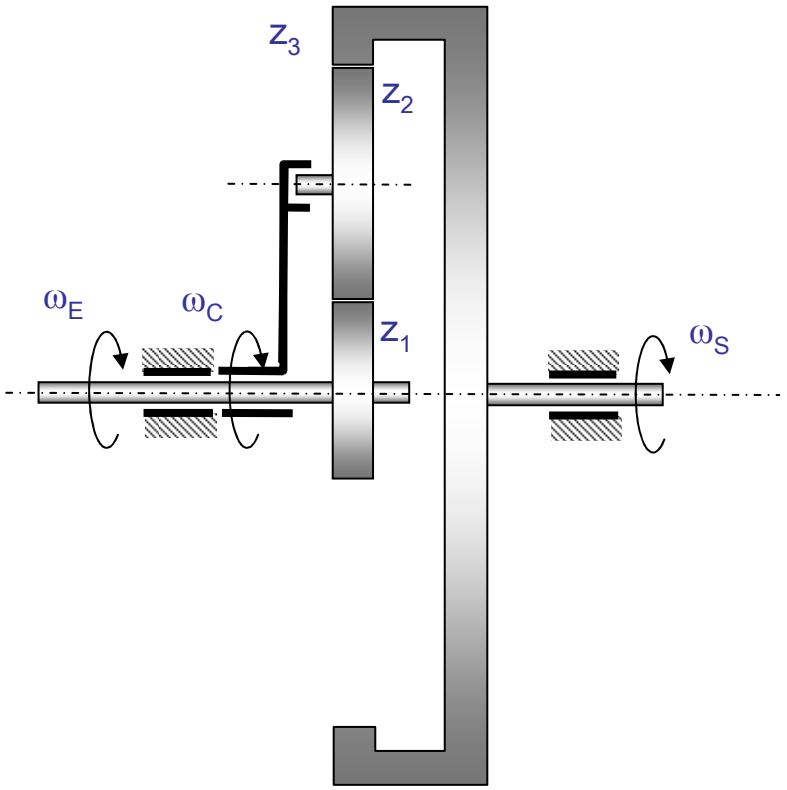
z_1 = 21 dientes.

z_2 = 21 dientes.

z_3 = 63 dientes.

ω_1 = 1

ω_C = -1



Problema 1

$$\mu_a = \frac{\omega_{3C}}{\omega_{1C}} = \frac{\omega_3 - \omega_C}{\omega_1 - \omega_C} = -\frac{z_1}{z_3}$$

$$\frac{\omega_3 - (-1)}{1 - (-1)} = -\frac{21}{63} = -\frac{1}{3}$$

$$\frac{\omega_3 + 1}{2} = -\frac{1}{3}$$

$$\boxed{\omega_3 = -\frac{5}{3}}$$

$$\mu_a = \frac{\omega_{2C}}{\omega_{1C}} = \frac{\omega_2 - \omega_C}{\omega_1 - \omega_C} = -\frac{z_1}{z_2}$$

$$\mu_a = \frac{\omega_2 - (-1)}{\omega_1 - (-1)} = -\frac{21}{21} = -1$$

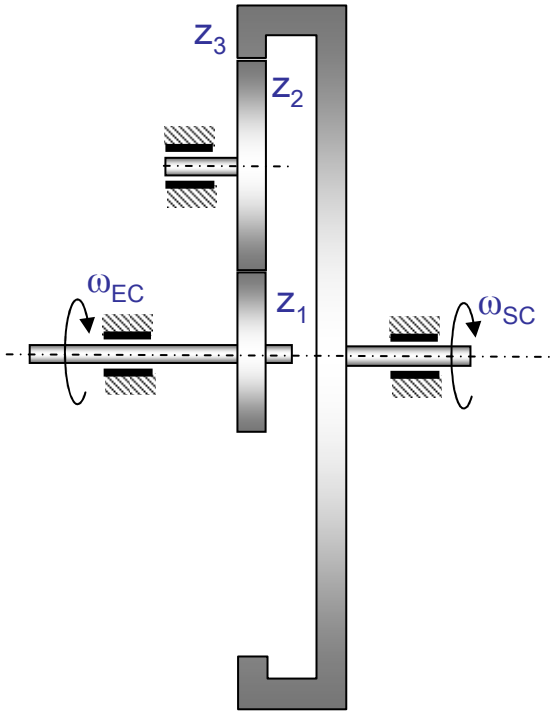
$$\boxed{\omega_2 = -3}$$

Otra forma para 2:

$$\mu_a = \frac{\omega_{2C}}{\omega_{3C}} = \frac{\omega_2 - \omega_C}{\omega_3 - \omega_C} = +\frac{z_3}{z_2}$$

$$\mu_a = \frac{\omega_2 - (-1)}{-\frac{5}{3} - (-1)} = \frac{63}{21} = 3$$

$$\boxed{\omega_2 = -3}$$



Chasis parado

Problema 2

En el tren epicicloidal de la figura la rueda 1 gira con una velocidad angular de 2.500 rpm. Se pide determinar la velocidad angular de la rueda 6.

$z_1 = 38$

$z_2 = 45$

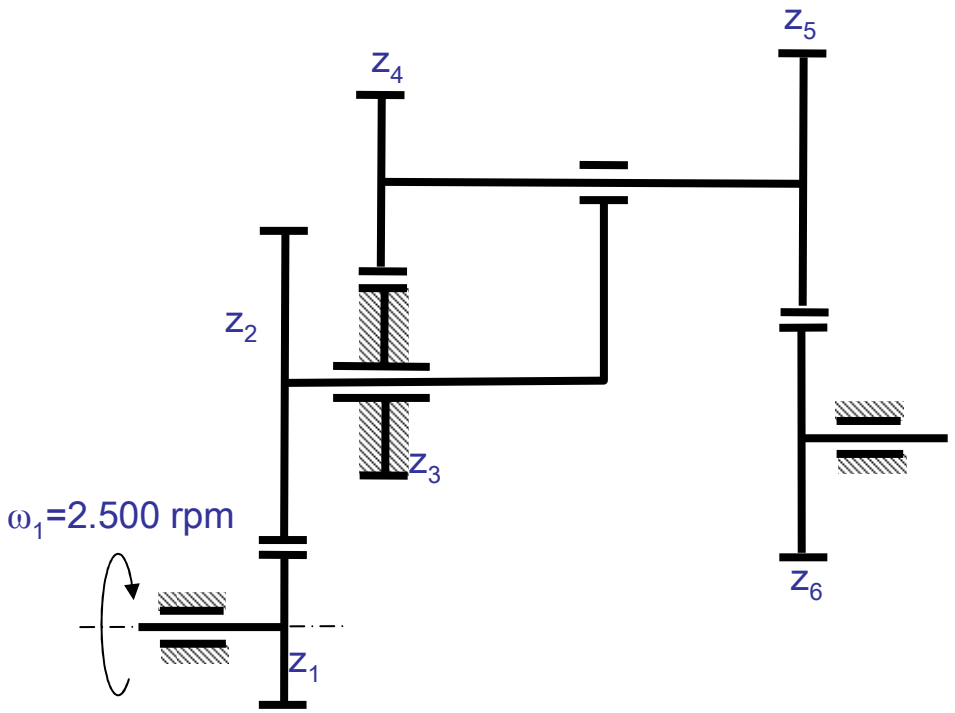
$z_3 = 39$

$z_4 = 38$

$z_5 = 39$

$z_6 = 40$

$\omega_1 = 2.500$ rpm



Problema 2

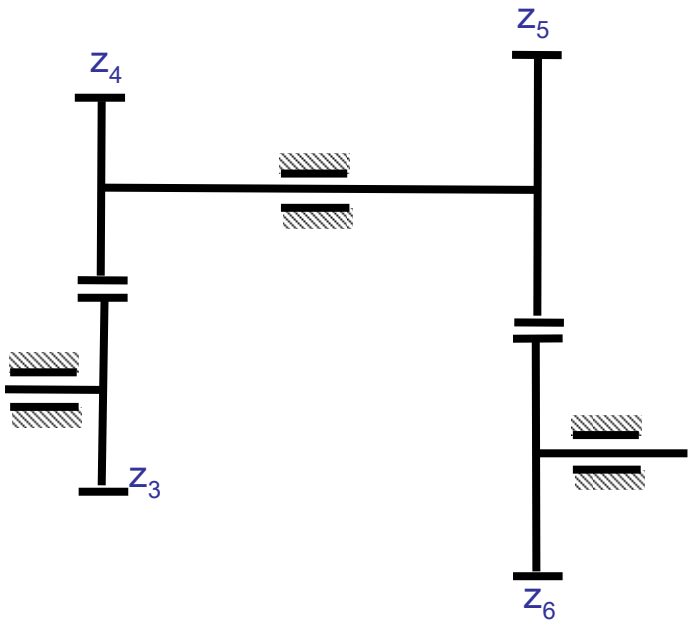
$$\omega_1 z_1 = -\omega_2 z_2$$

$$\omega_2 = -\omega_1 \frac{z_1}{z_2} = -2500 \frac{38}{45} = -\frac{1900}{9}$$

$$\omega_2 = \omega_c$$

$$\mu_a = \frac{\omega_{6C}}{\omega_{3C}} = \frac{\omega_6 - \omega_C}{0 - \omega_C} = \frac{z_3 z_5}{z_4 z_6} = \frac{39\ 39}{38\ 40} = \frac{1521}{1520}$$

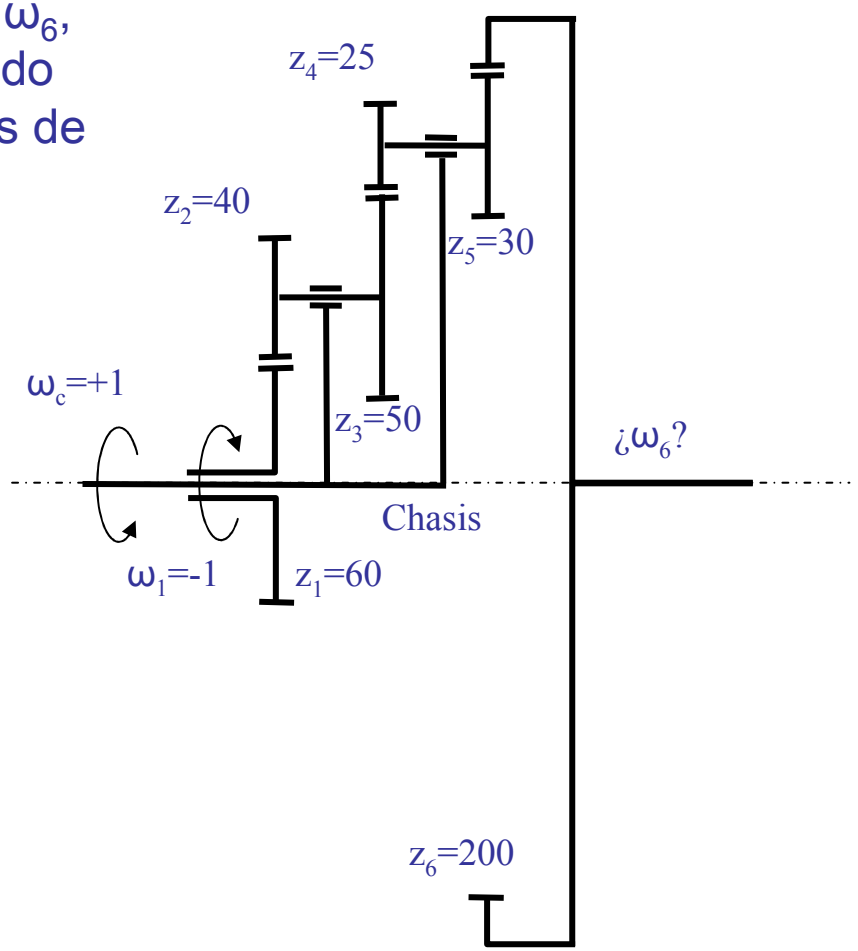
$$\omega_6 = \frac{39\ 39}{38\ 40} = \frac{1521}{1520}\omega_C - \omega_C = 1{,}388 \text{ rpm}$$



Chasis parado

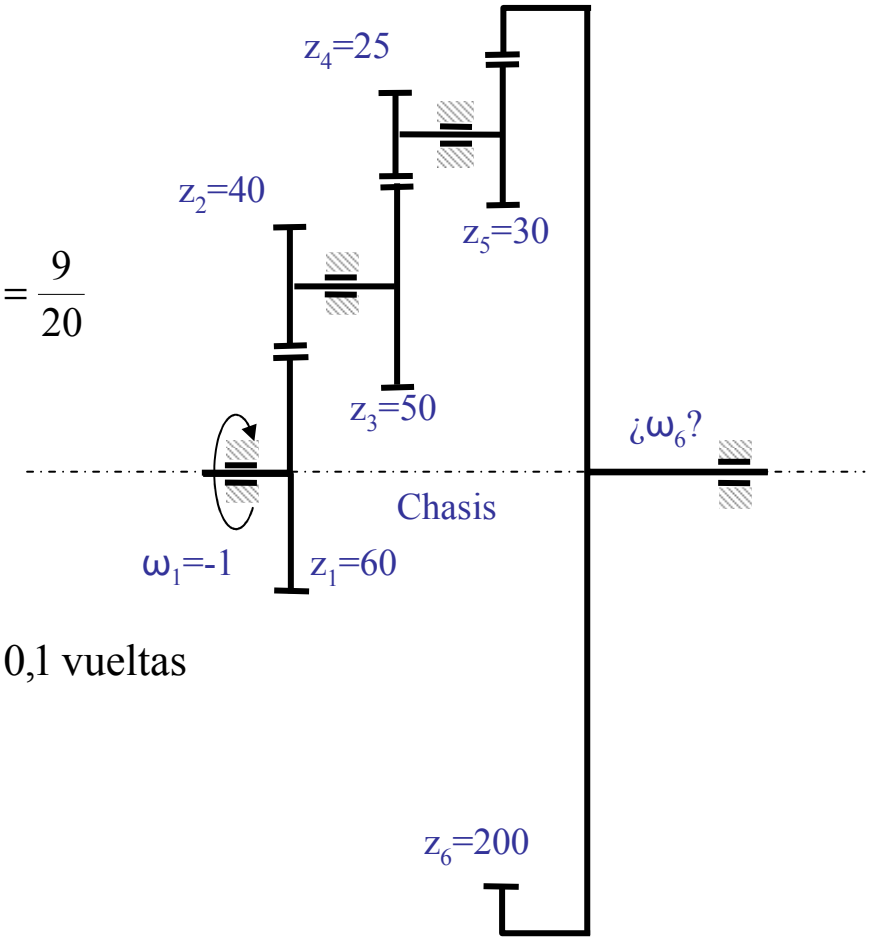
Problema 3

Obtener la velocidad angular de salida, ω_6, en el tren epicicloidal de la figura teniendo en cuenta que la velocidad del chasis es de ω_c=+1 y ω_1=-1.



Problema 3

$$\mu_a = \frac{\omega_{6C}}{\omega_{1C}} = \frac{\omega_6 - \omega_C}{\omega_1 - \omega_C} = +\frac{z_1 z_3 z_5}{z_2 z_4 z_6} = \frac{60\ 50\ 30}{40\ 25\ 200} = \frac{9}{20}$$



$$\omega_6 = \omega_C + \frac{9}{20}(\omega_1 - \omega_C) = 1 + \frac{9}{20}(-1-1) = 0{,}1 \text{ vueltas}$$

Chasis parado

Problema 4

El piñón 1 del tren epicicloidal de la figura gira +6 vueltas. Se pide hallar las vueltas que gira las rueda 13 y la relación de transmisión que proporciona el tren.

$z_1 = 30$ $z_2 = 40$

$z_3 = 90$ $z_4 = 80$

$z_5 = 30$ $z_6 = 200$

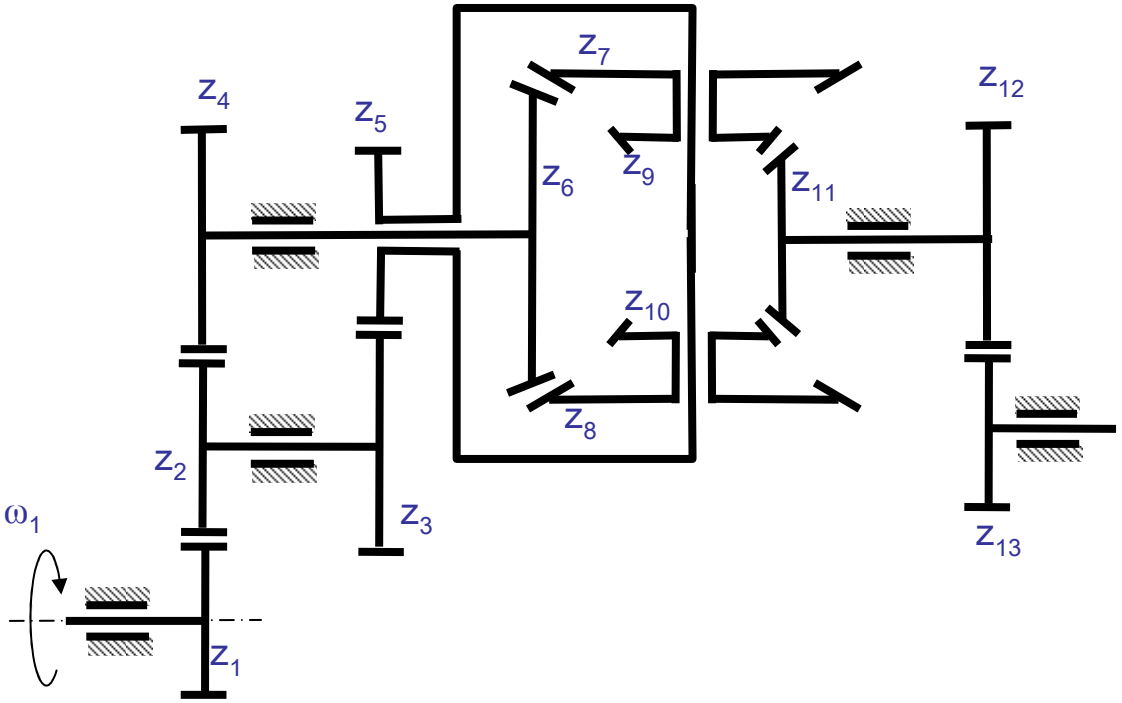
$z_7 = 50$ $z_8 = 50$

$z_9 = 30$ $z_{10} = 30$

$z_{11} = 60$ $z_{12} = 90$

$z_{13} = 30$

$\omega_1 = +6$



Problema 4

$$\omega_1 z_1 = -\omega_2 z_2 \qquad \boxed{\omega_2 = \omega_3 = -\omega_1 \frac{z_1}{z_2} = -6\frac{30}{40} = -\frac{45}{10}}$$

$$\omega_2 z_2 = -\omega_4 z_4 \qquad \boxed{\omega_4 = \omega_6 = -\omega_2 \frac{z_2}{z_4} = -\frac{9}{4}}$$

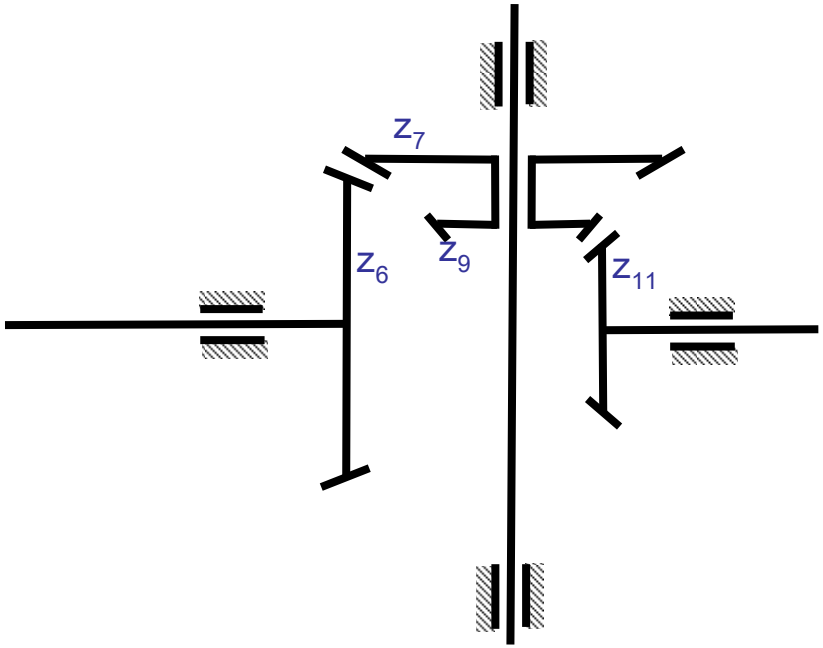
$$\omega_5 z_5 = -\omega_3 z_3 \qquad \boxed{\omega_5 = \omega_C = -\omega_3 \frac{z_3}{z_4} = \frac{27}{2}}$$

$$\mu_a = \frac{\omega_{11C}}{\omega_{6C}} = \frac{\omega_{11} - \omega_C}{\omega_6 - \omega_C} = -\frac{z_6 z_9}{z_7 z_{11}}$$

$$\frac{\omega_{11} - \frac{27}{2}}{-\frac{9}{4} - \frac{27}{2}} = -\frac{200\ 30}{50\ 60} \qquad \boxed{\omega_{11} = \omega_{12} = 36}$$

$$\omega_{13} z_{13} = -\omega_{12} z_{12} \qquad \boxed{\omega_{13} = -108}$$

$$\boxed{\mu = \frac{\omega_{13}}{\omega_1} = -\frac{108}{6} = -36}$$



Chasis parado