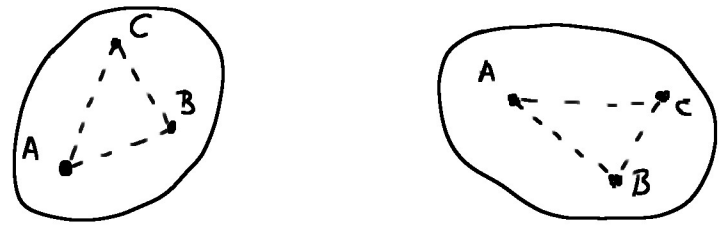
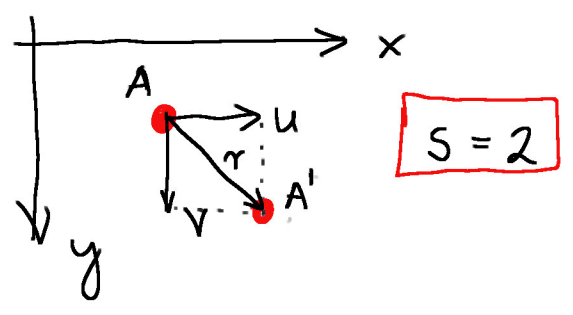


KINEMATYCZNA ANALIZA KONSTRUKCJI PŁASKICH

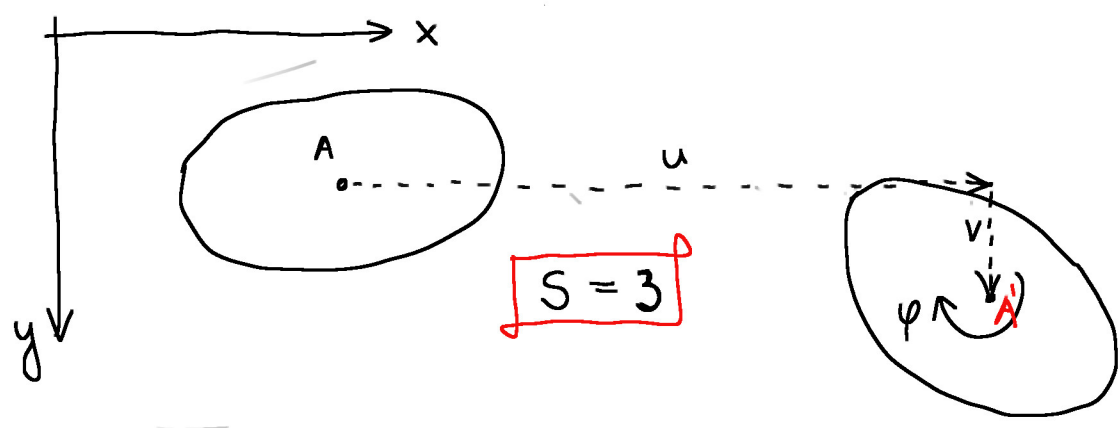
1. TARCZA SZTYWNA



2. PUNKT SWOBODNY



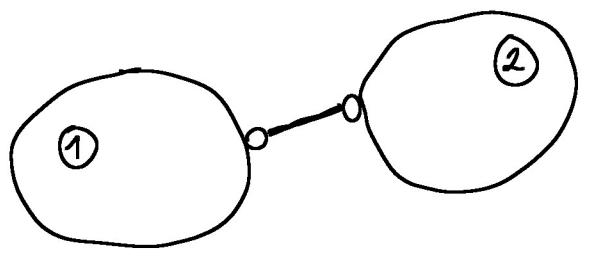
3. TARCZA SWOBODNA



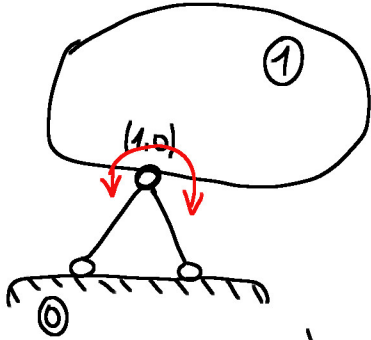
4. TARCZA PODSTAWOWA



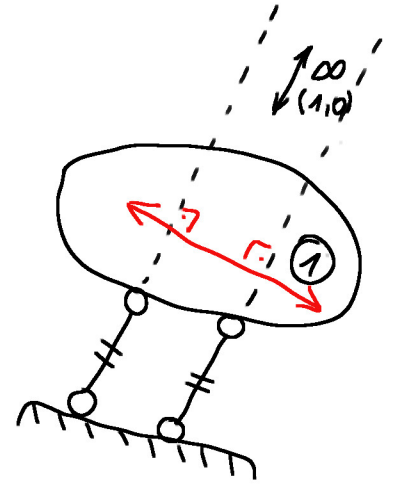
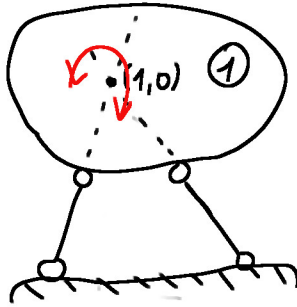
5. WIĘŹ ELEMENTARNA



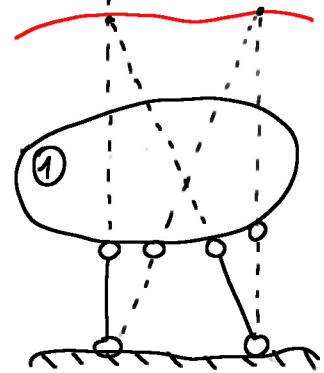
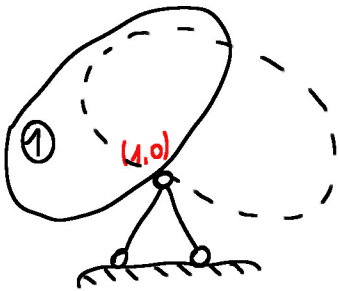
6. POŁĄCZENIA TARCZ Z OSTOJĄ



TRWAŁY ŚRODEK OBROTU



CHWILOWY ŚRODEK OBROTU



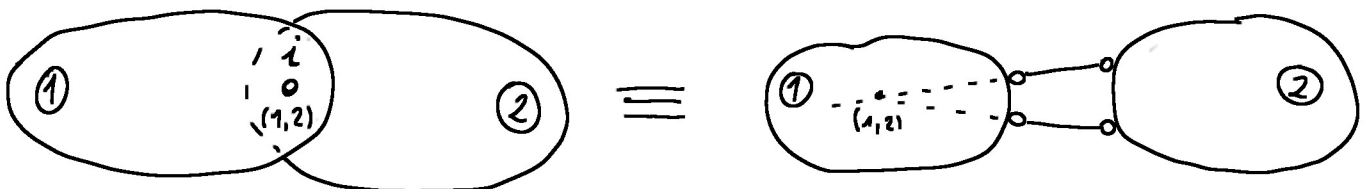
ZAŁOŻENIE

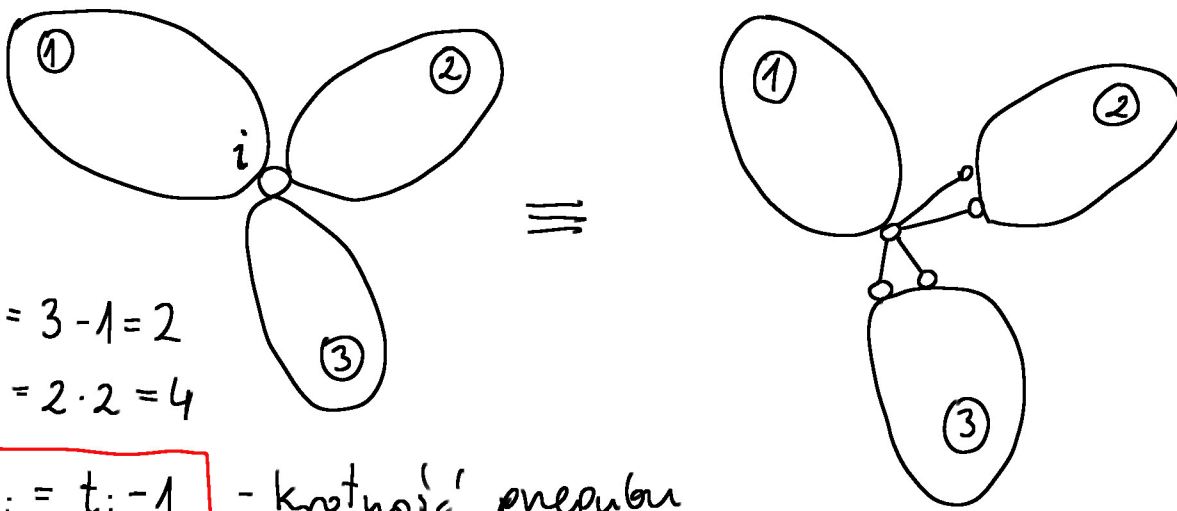
MAŁE PRZEMIESZCZENIA



CHWILOWY ŚR. OBR. = TRWAŁY ŚR. OBR.

7. WZAJEMNE POŁĄCZENIA TARCZ





$$k_i = 3 - 1 = 2$$

$$e_i = 2 \cdot 2 = 4$$

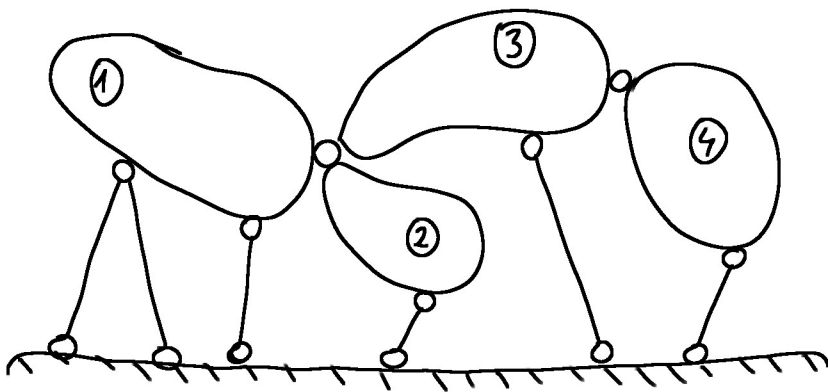
$$k_i = t_i - 1 \text{ - krotnosć' pręgu}$$

t_i - liczba torów

e_i - liczba więzi

$$e_i = 2k_i = 2(t_i - 1)$$

t_i	k_i	e_i
2	1	2
3	2	4
4	3	6
5	4	8



$$t = 4$$

$$e = 12$$

$$e = 3t$$

$$12 = 3 \cdot 4$$

* Warunek ilościowy geometrycznej niezmierności

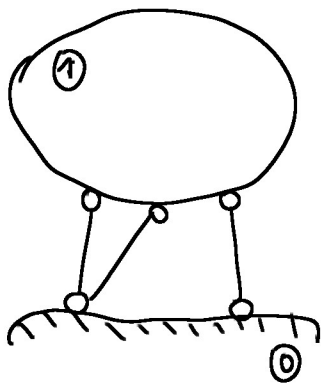
$$e = 3t, \quad n = e - 3t$$

$n \geq 0$ war. spełniony

$n < 0$ war. niespełniony \rightarrow GZ!

8. TWIERDZENIA O TARCZACH

Tw. o 2. tarczach



$$t_1 \equiv t_0$$

$$t = 1$$

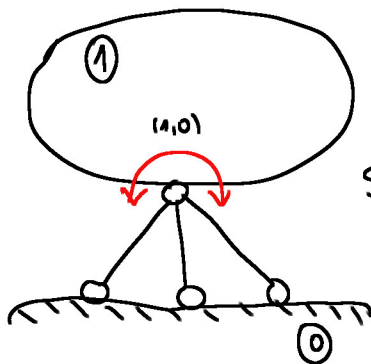
GN

$$e = 3$$

$$n = e - 3t$$

$$n = 3 - 3 \cdot 1 = 0$$

* war. ilościowy spełniony



$$s = 1$$

GZ!

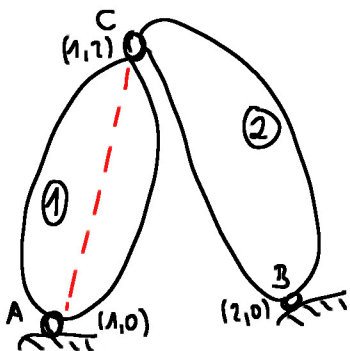
$$t = 1$$

$$e = 3$$

$$n = 3 - 3 \cdot 1 = 0$$

* war. ilościowy spełniony

* war. jakościowy

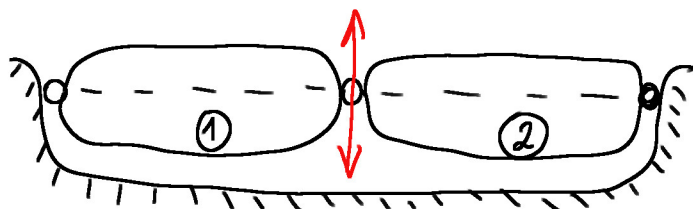
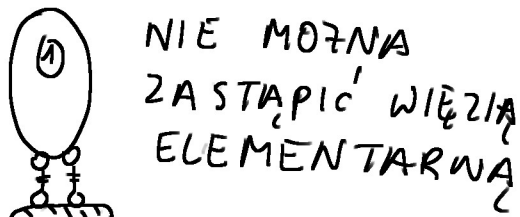


$$e = 6$$

$$t = 2$$

$$n = 6 - 3 \cdot 2 = 0 - \text{war. ilościowy spełniony}$$

* war. jakościowy spełniony na mocy tw. o 2. tarczach. Układ GN.

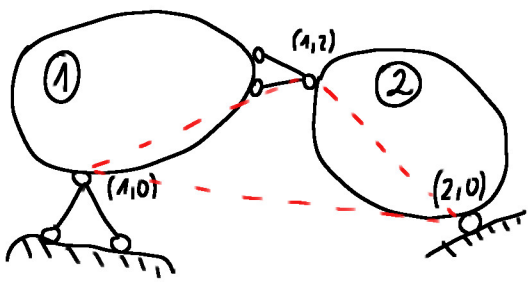


$$t = 2, e = 6$$

$$n = 6 - 3 \cdot 2 = 0 - \text{war. spełniony}$$

GZ!

TWIERDZENIE ARONHOLDTA (O 3. TARCZACH)



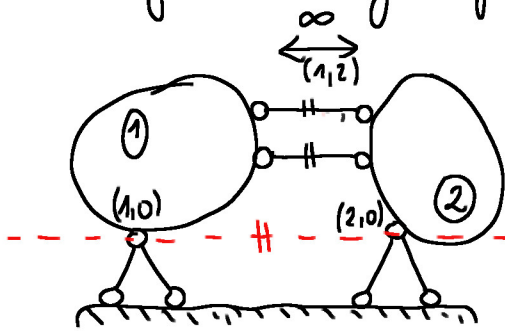
$$e = 6$$

$$t = 2$$

$$n = 6 - 3 \cdot 2 = 0 \quad \text{- war ilościowy spełniony}$$

GN

war. jakościowy spełniony na mocy tw. o 3. tarczach.



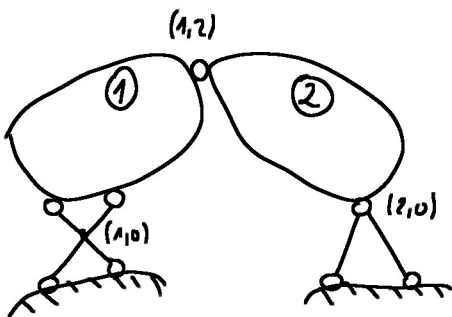
$$e = 6$$

$$t = 2$$

$$n = 6 - 3 \cdot 2 = 0$$

(1,0), (2,0), (1,2) leżą na jednej prostej

GZ!

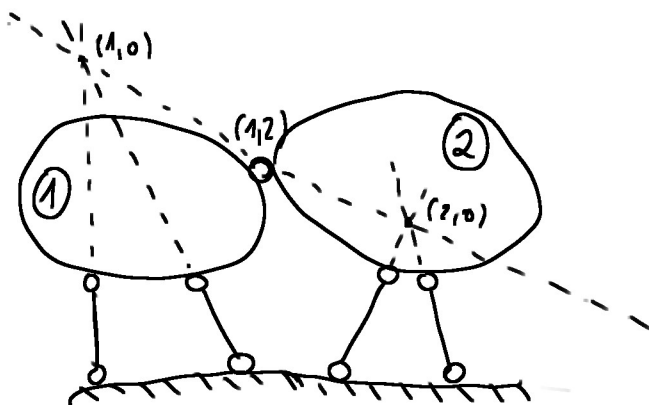


$$e = 6$$

$$t = 2$$

$$n = 6 - 3 \cdot 2 = 0$$

2 tw. o 3. tarczach GN

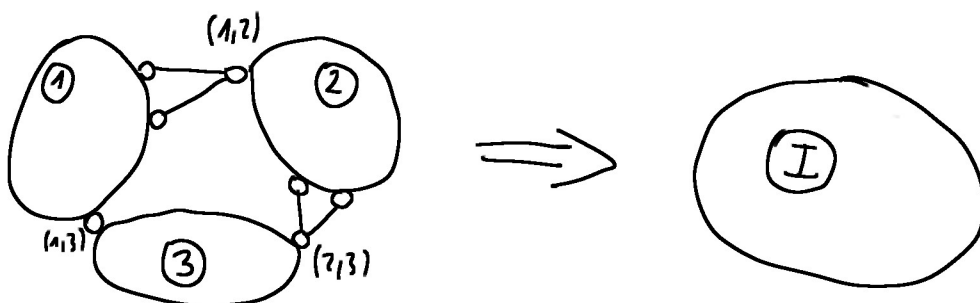


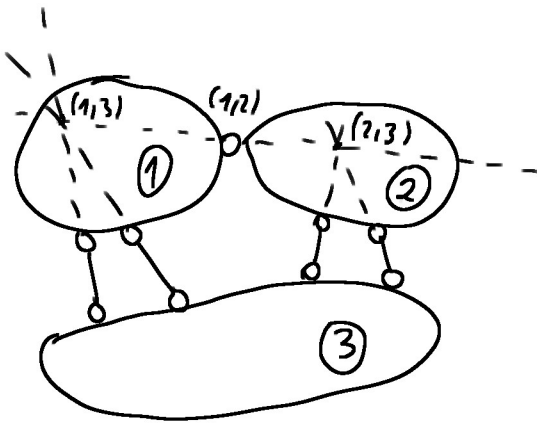
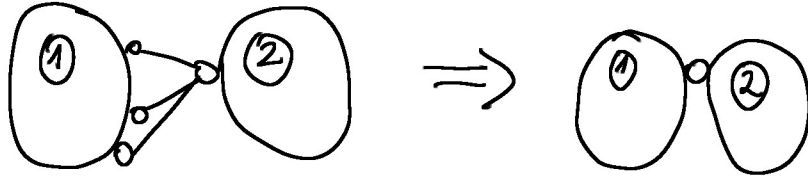
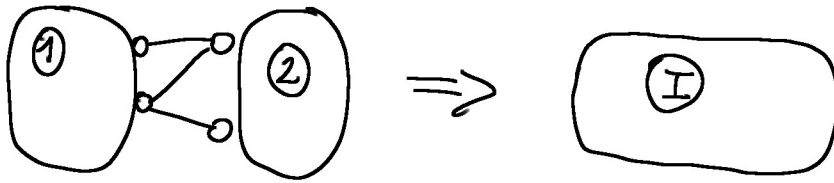
$$e = 6$$

$$t = 2$$

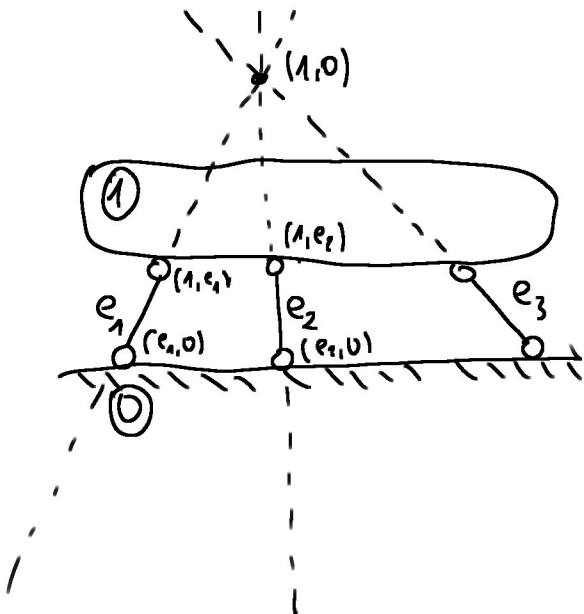
$$n = 6 - 3 \cdot 2 = 0$$

GZ!





WYZNACZANIE ŚRODKÓW OBROTU



GZ

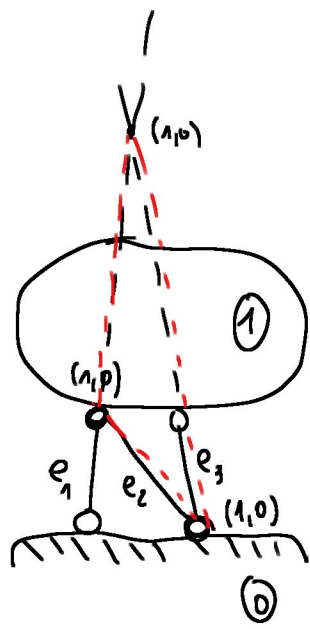
$$1) \begin{matrix} e_1 \\ 1 \quad 0 \\ e_2 \end{matrix} \rightarrow (1, 0)$$

lub

$$2) \begin{matrix} e_1 \\ 1 \quad 0 \\ e_3 \end{matrix} \rightarrow (1, 0)$$

lub

$$3) \begin{matrix} e_2 \\ 1 \quad 0 \\ e_3 \end{matrix} \rightarrow (1, 0)$$



$$\begin{aligned}
 1) \quad & -1 \begin{matrix} e_1 \\ e_2 \end{matrix} 0 \rightarrow (1,0)_1 \\
 2) \quad & 1 \begin{matrix} e_1 \\ e_3 \end{matrix} 0 \rightarrow (1,0)_2 \\
 3) \quad & 1 \begin{matrix} e_2 \\ e_3 \end{matrix} 0 \rightarrow (1,0)_3
 \end{aligned}$$