

Mechanik

Grundlagen

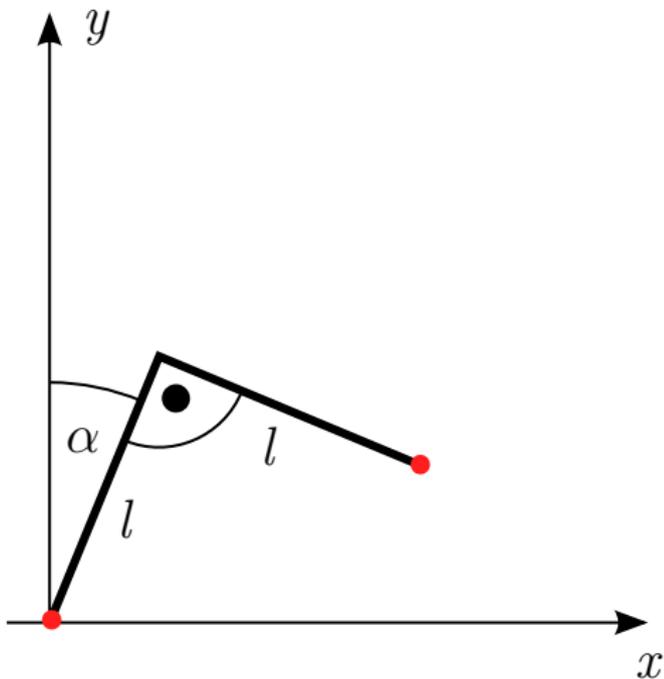
Dominik Zobel

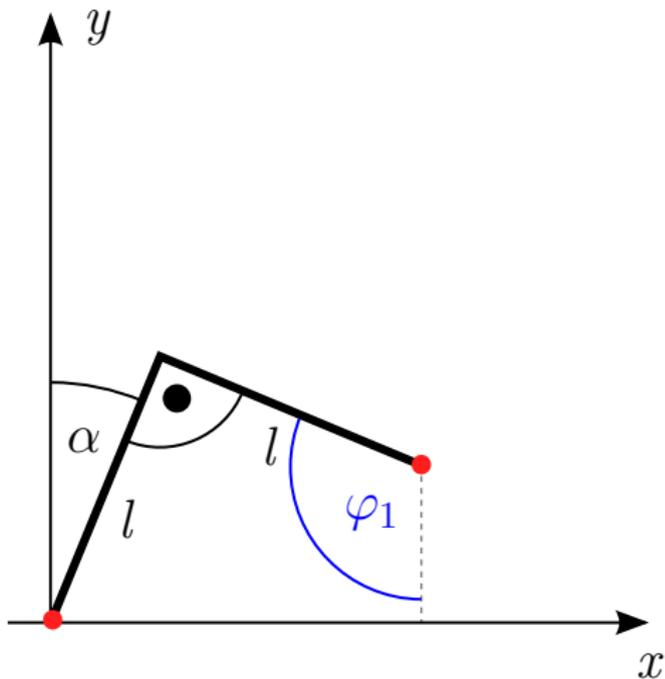
- Wissen Mathematik

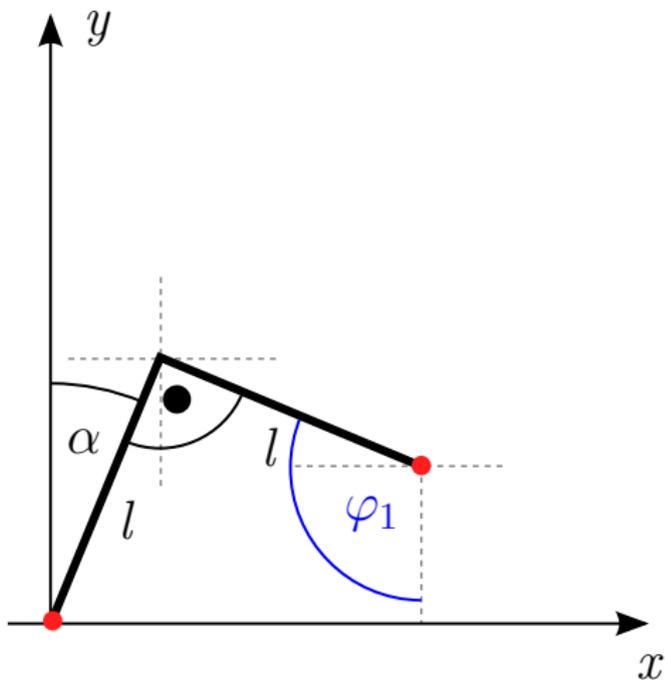
- Wissen Mechanik

- Wissen Mathematik
 - Winkelerkennung
 - Sinus und Kosinus
 - Vektoren
- Wissen Mechanik

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 - Winkelerkennung
 - Sinus und Kosinus
 - Vektoren
- Wissen Mechanik
 - Rechtssysteme
 - Freischneiden
 - Bestimmtheit
 - Schwerpunkte





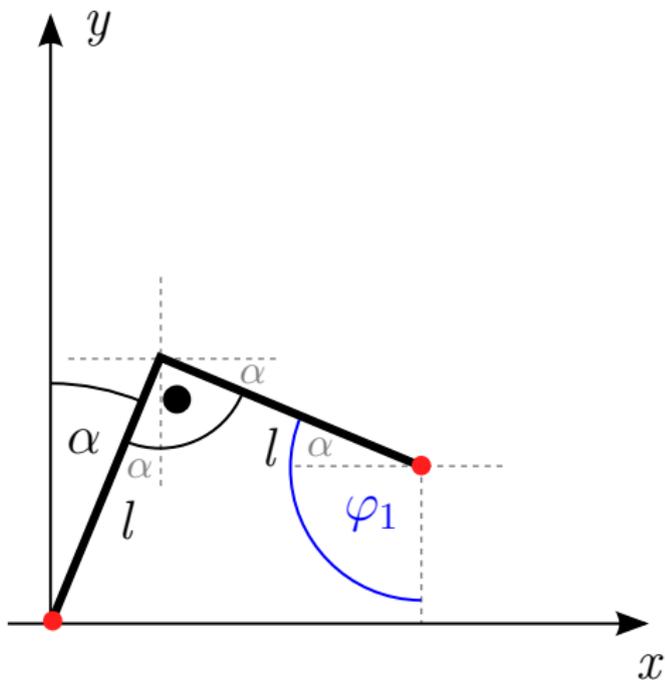


Was stimmt?

$$\varphi_1 = 180^\circ - \alpha$$

$$\varphi_1 = 90^\circ + \alpha$$

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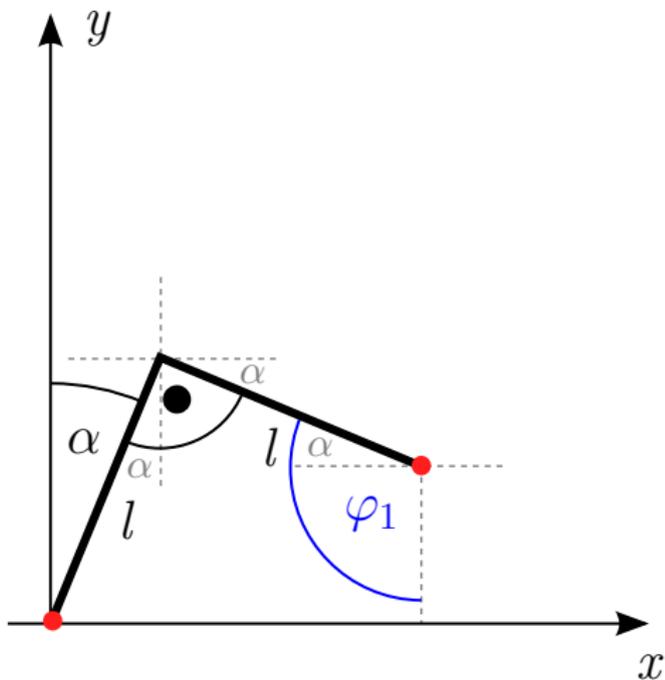


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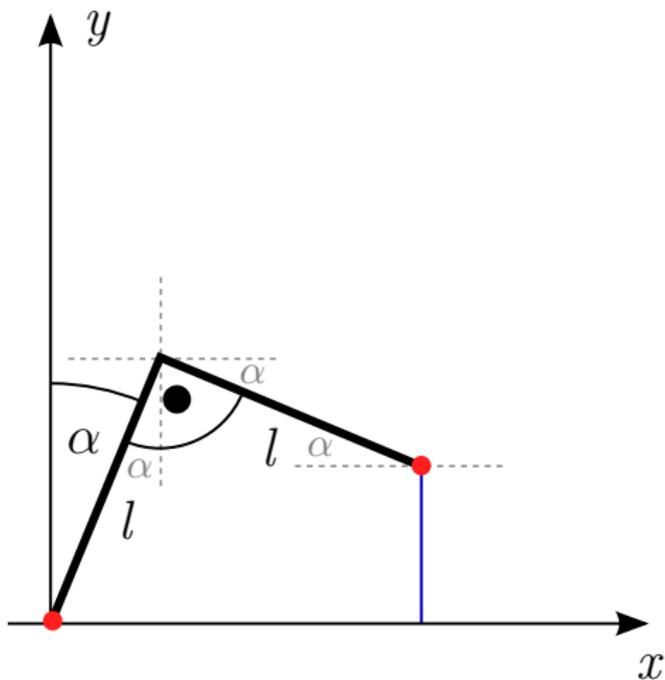


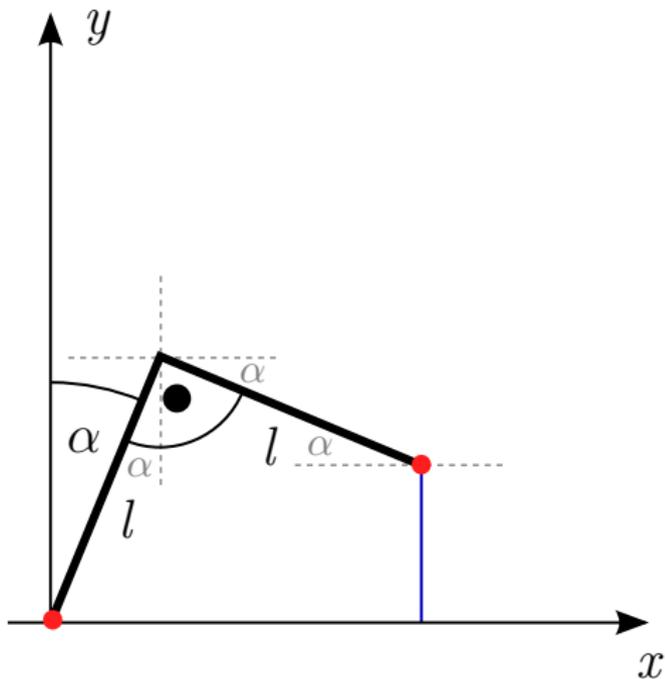
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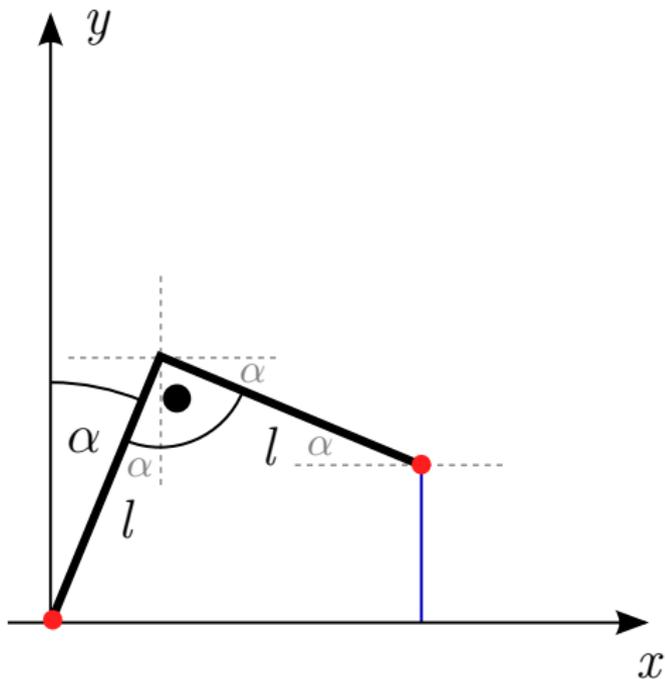


Was stimmt?

$$l - \sin(\alpha)$$

$$l \sin(\alpha) - l \cos(\alpha)$$

$$l \cos(\alpha) - l \sin(\alpha)$$

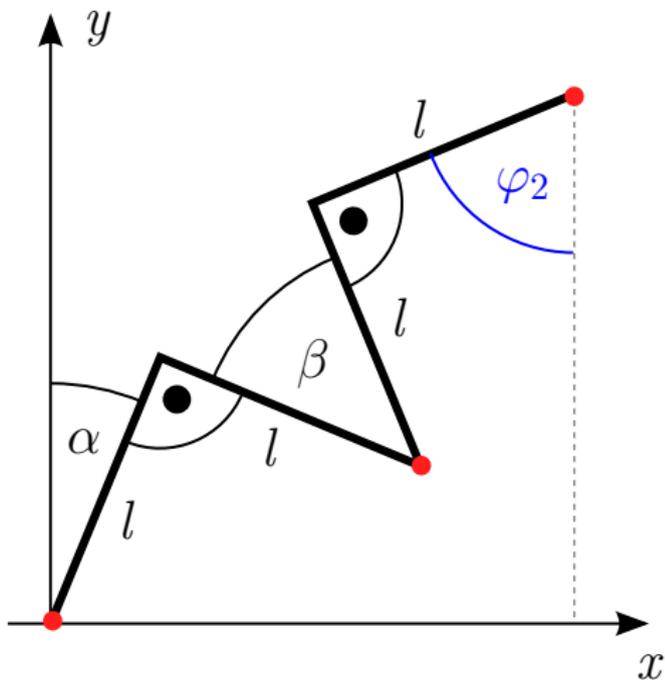


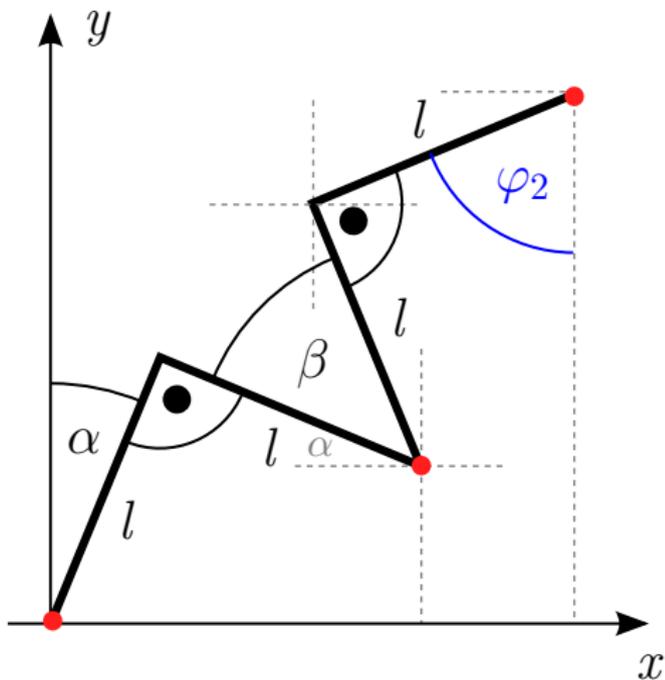
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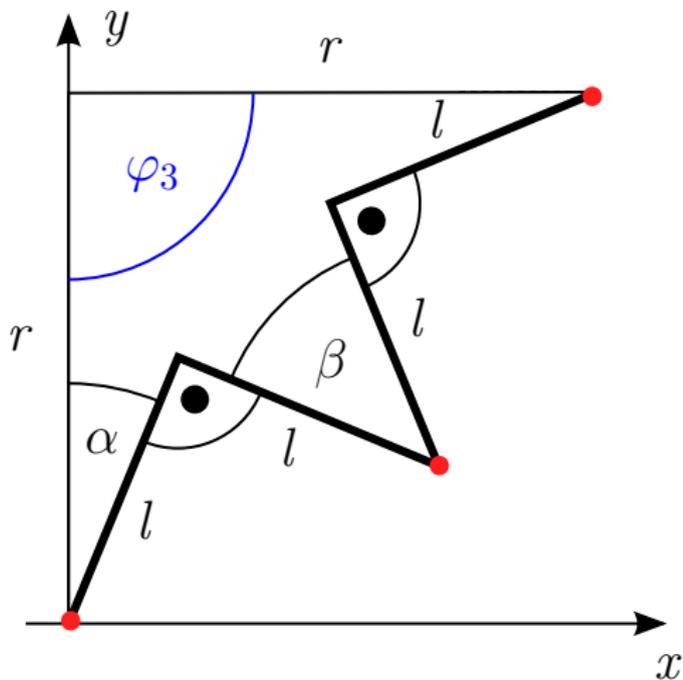


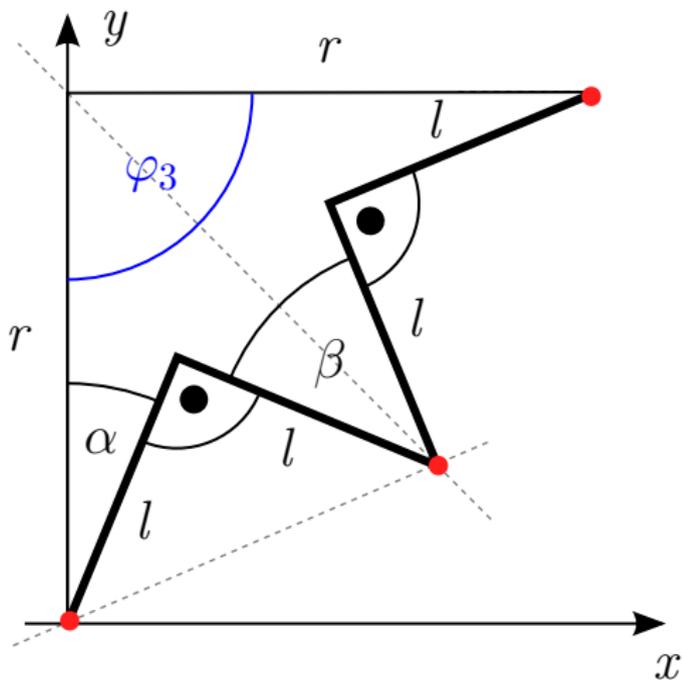
Was stimmt?

$$\varphi_2 = \alpha + \beta$$

$$\varphi_2 = 90 - \beta$$

$$\varphi_2 = 90 - \alpha$$



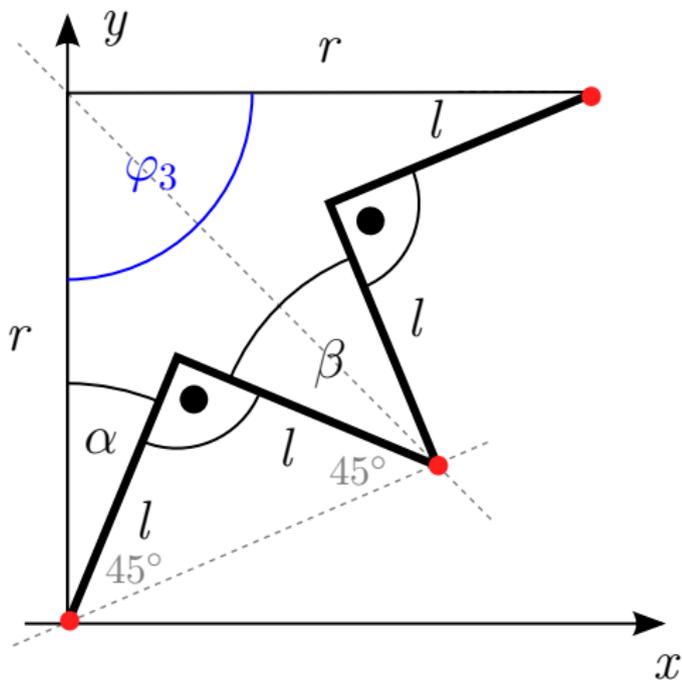


Was stimmt?

$$\varphi_3 = 180^\circ - 2\alpha - \beta$$

$$\varphi_3 = 90^\circ$$

$$\varphi_3 = 2\alpha + \beta$$

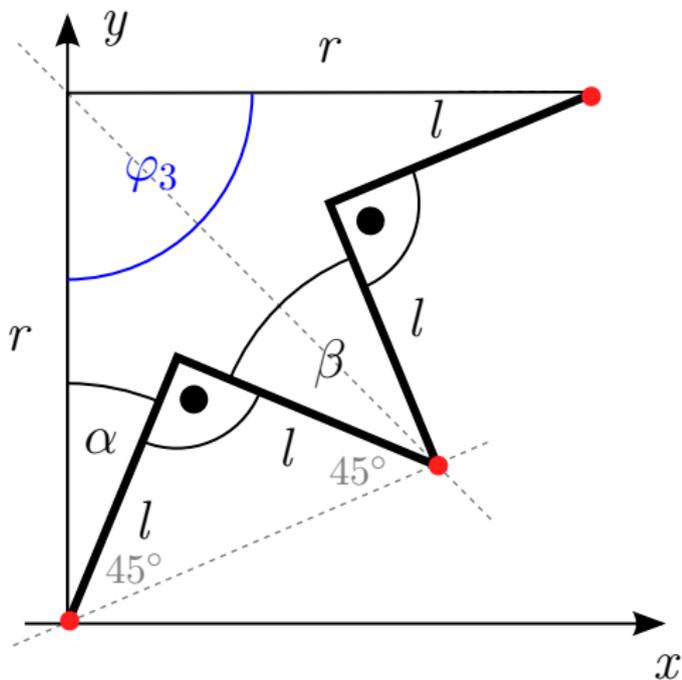


Was stimmt?

$$\varphi_3 = 180^\circ - 2\alpha - \beta$$

$$\varphi_3 = 90^\circ$$

$$\varphi_3 = 2\alpha + \beta$$



Was stimmt?

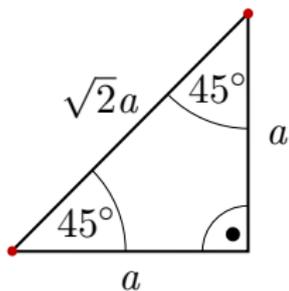
$$\varphi_3 = 180^\circ - 2\alpha - \beta$$

$$\varphi_3 = 90^\circ$$

$$\varphi_3 = 2\alpha + \beta$$

$$\sin(0^\circ) = 0 = \cos(90^\circ)$$

$$\sin(90^\circ) = \frac{\sqrt{4}}{2} = 1 = \cos(0^\circ)$$

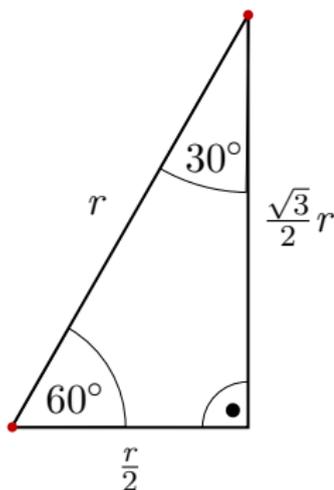


$$\sin(0^\circ) = 0 = \cos(90^\circ)$$

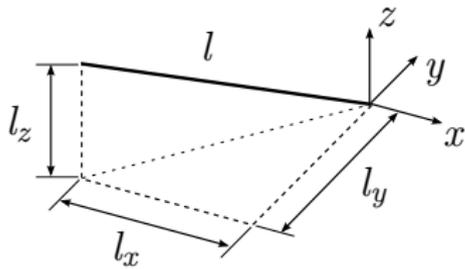
$$\sin(45^\circ) = \frac{\sqrt{2}}{2} = \cos(45^\circ)$$

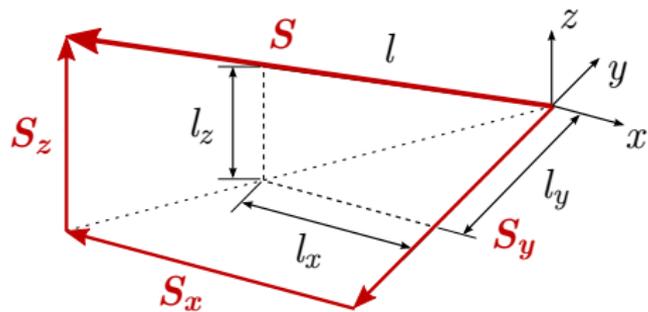
$$\sin(90^\circ) = \frac{\sqrt{4}}{2} = 1 = \cos(0^\circ)$$

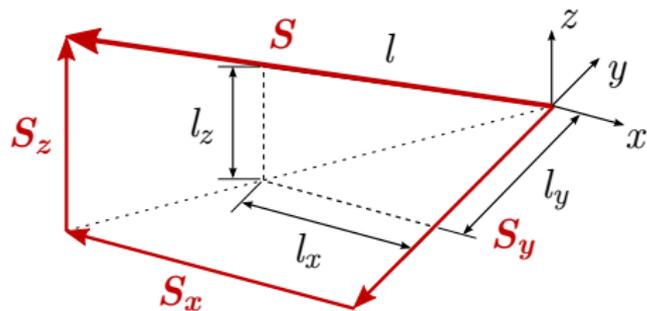
Sinus und Kosinus



$\sin(0^\circ)$	$=$	0	$=$	$\cos(90^\circ)$
$\sin(30^\circ)$	$=$	$\frac{\sqrt{1}}{2} = \frac{1}{2}$	$=$	$\cos(60^\circ)$
$\sin(45^\circ)$	$=$	$\frac{\sqrt{2}}{2}$	$=$	$\cos(45^\circ)$
$\sin(60^\circ)$	$=$	$\frac{\sqrt{3}}{2}$	$=$	$\cos(30^\circ)$
$\sin(90^\circ)$	$=$	$\frac{\sqrt{4}}{2} = 1$	$=$	$\cos(0^\circ)$

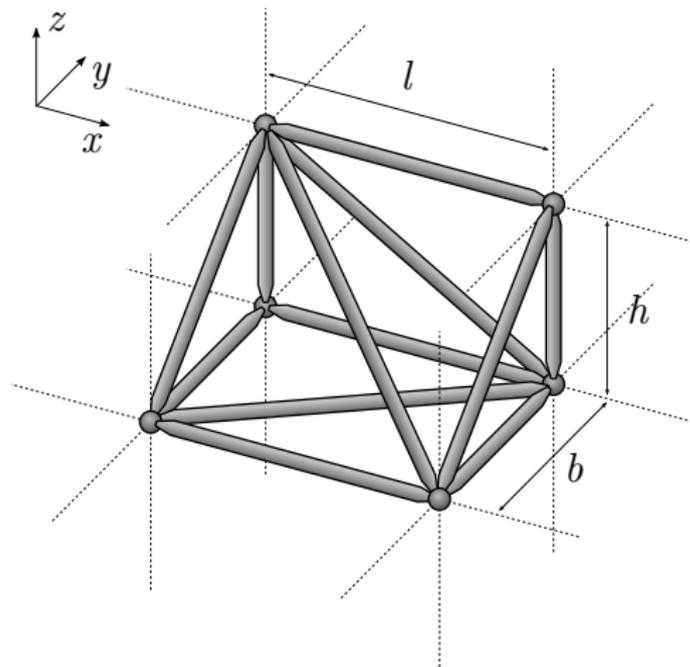




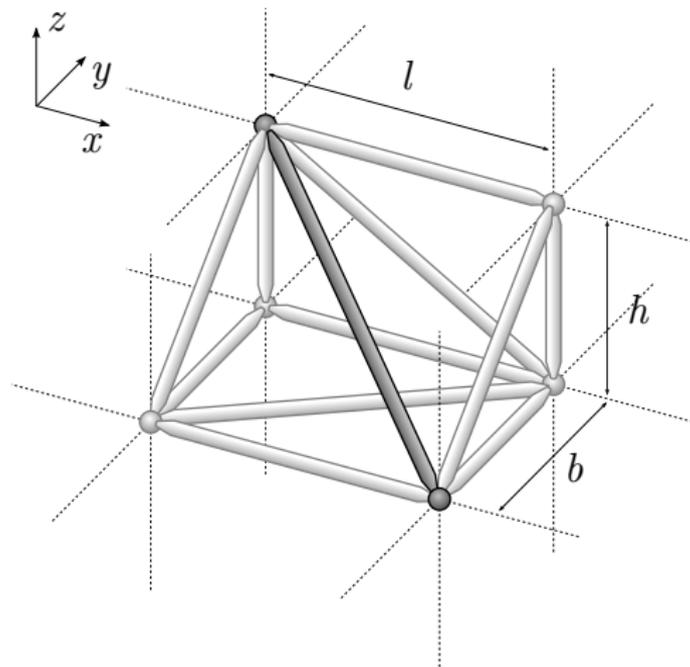


$$\frac{l_x}{l} = \frac{S_x}{S}$$

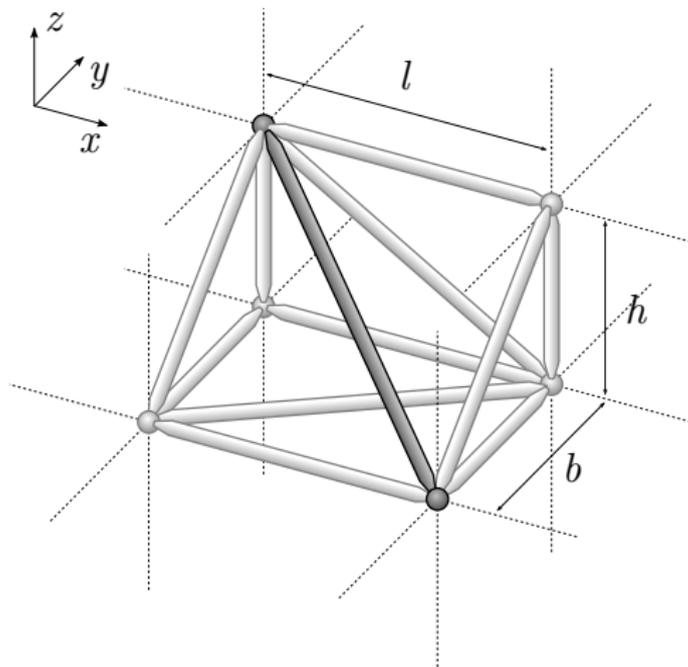
Vektoren am Fachwerk



Vektoren am Fachwerk



Vektoren am Fachwerk



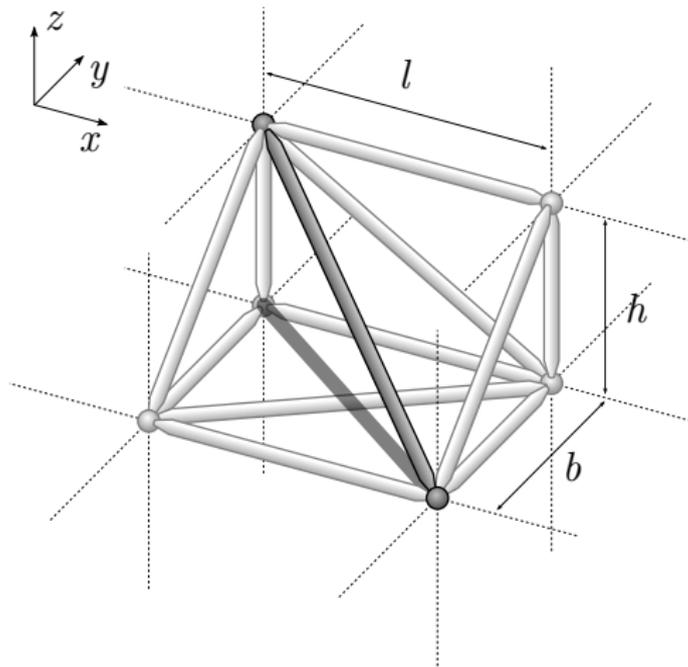
Was stimmt?

$$\sqrt{\sqrt{l^2 + b^2}^2 + h^2}$$

$$\sqrt{l^2 + b^2 + h^2}$$

$$\sqrt{l^2 + b^2} + \sqrt{h^2}$$

Vektoren am Fachwerk



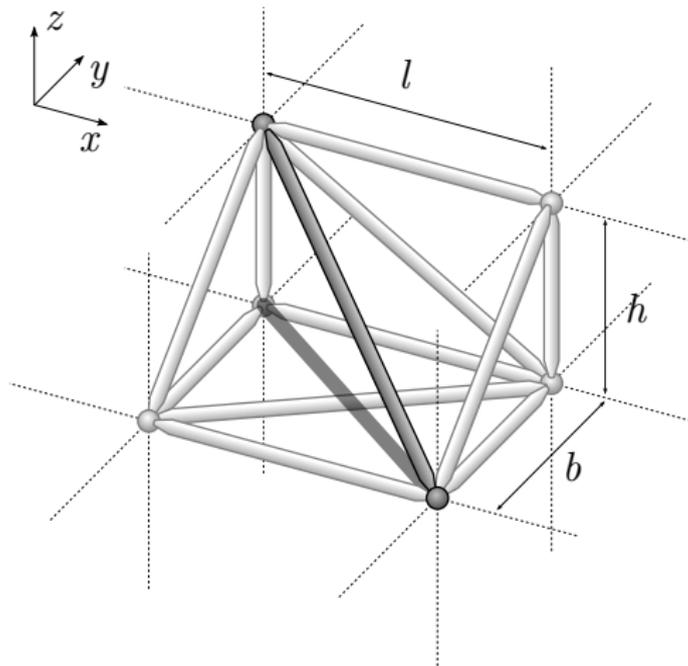
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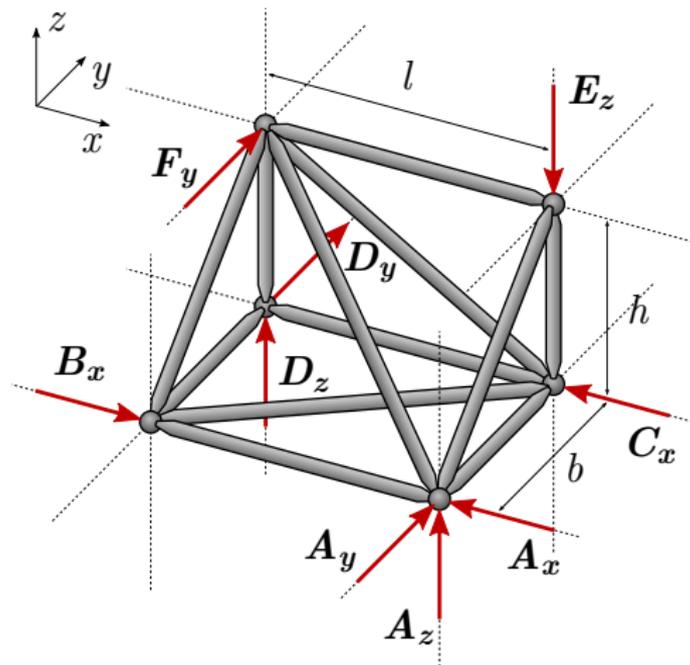
Was stimmt?

$$\sqrt{\sqrt{l^2 + b^2}^2 + h^2}$$

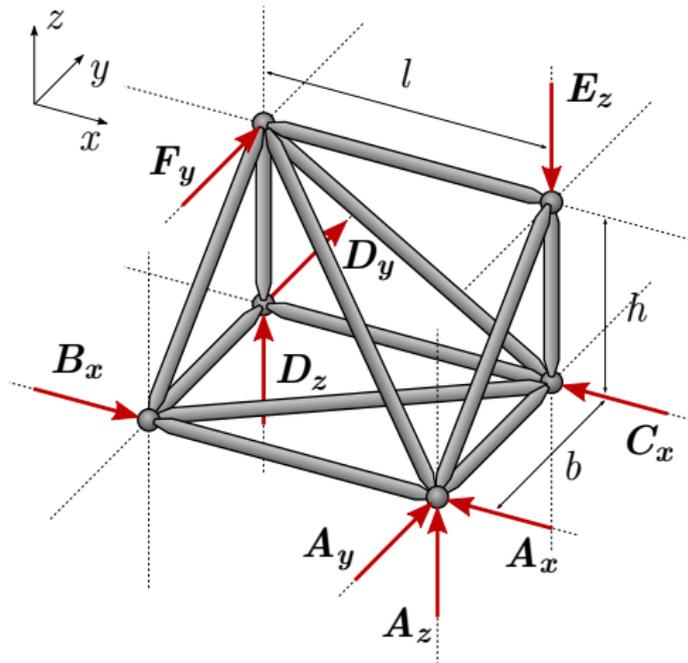
$$\sqrt{l^2 + b^2 + h^2}$$

$$\sqrt{l^2 + b^2} + \sqrt{h^2}$$

Vektoren am Fachwerk



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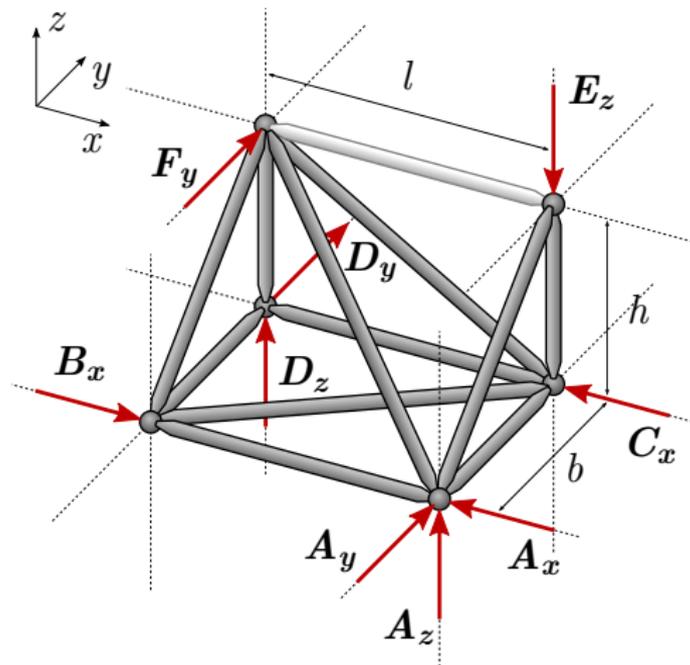
Was stimmt?

2 Nullstäbe

3 Nullstäbe

4 Nullstäbe

Vektoren am Fachwerk



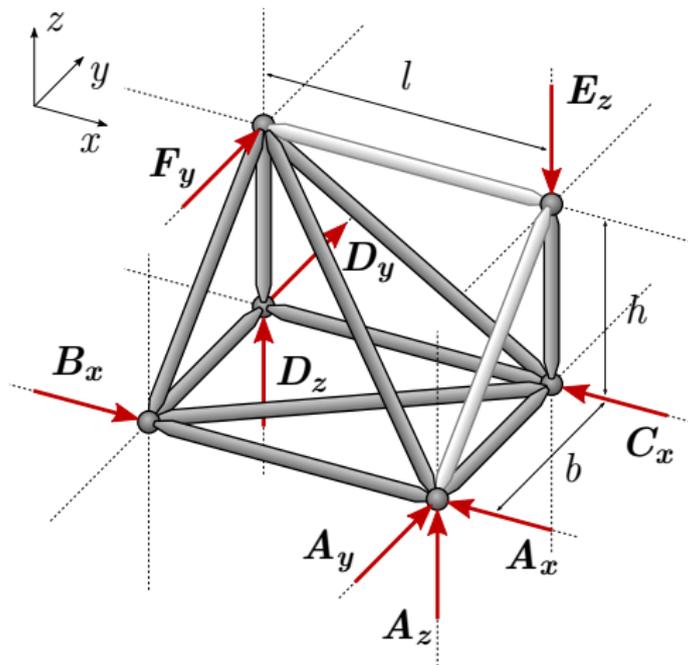
Was stimmt?

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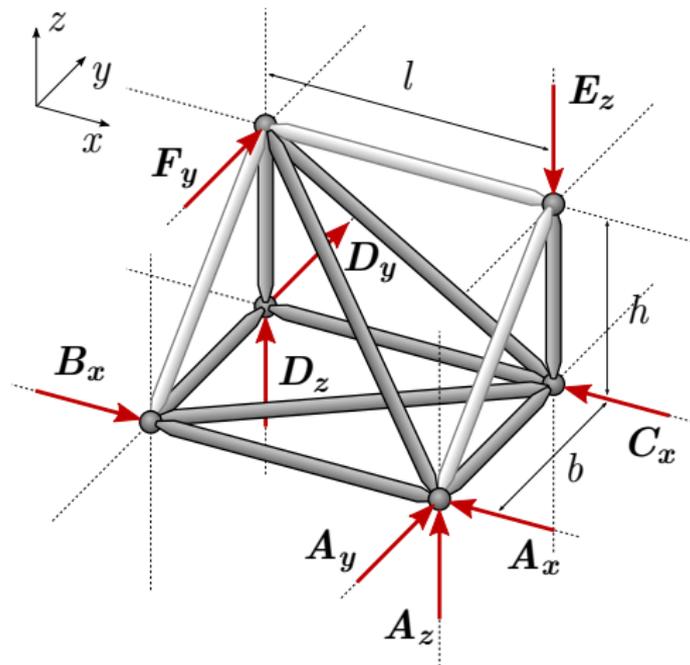
Was stimmt?

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Vektoren am Fachwerk



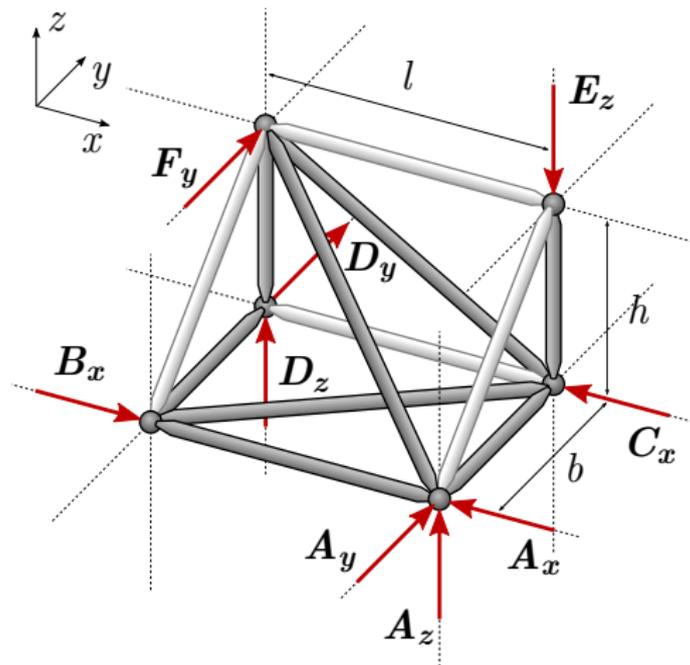
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Vektoren am Fachwerk



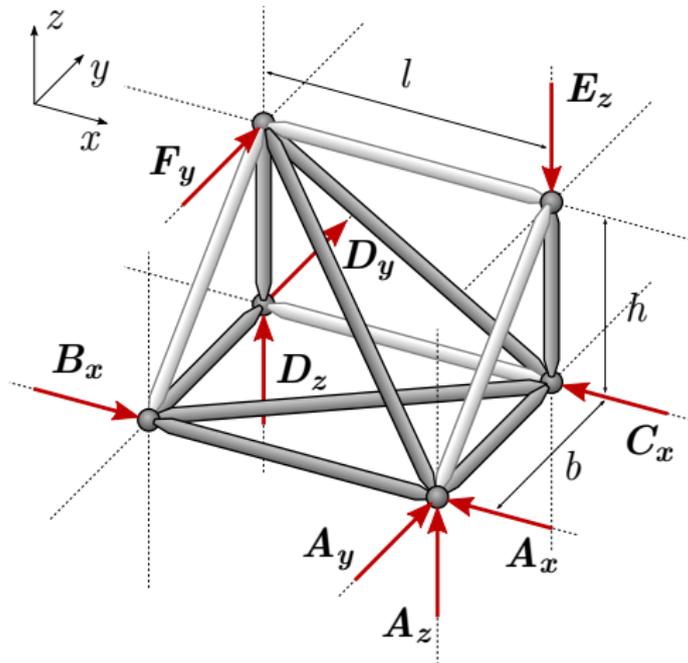
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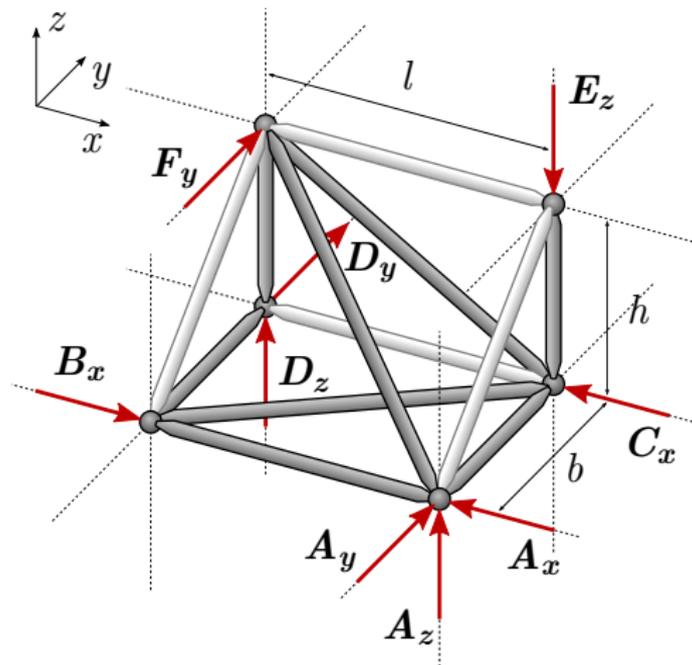


Was stimmt?

2 Nullstäbe

3 Nullstäbe

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Was stimmt?

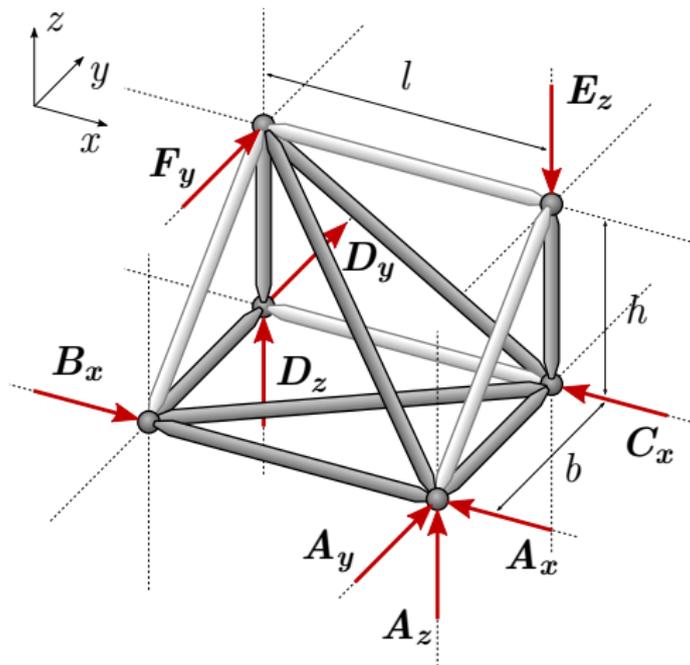
$$S_{AF} = \frac{\sqrt{l^2 + b^2 + h^2}}{b} F_y$$

$$S_{AF} = -\frac{\sqrt{l^2 + b^2 + h^2}}{h} A_z$$

$$S_{AF} = -\frac{b}{\sqrt{l^2 + b^2 + h^2}} F_y$$

$$S_{AF} = \frac{h}{\sqrt{l^2 + b^2 + h^2}} A_z$$

Vektoren am Fachwerk



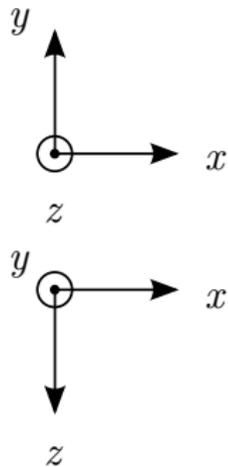
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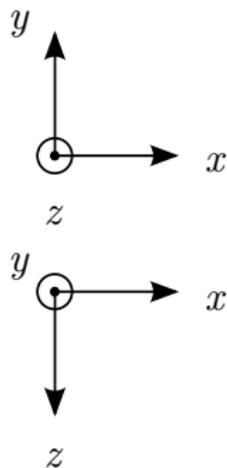
$$S_{AF} = \frac{\sqrt{l^2+b^2+h^2}}{b} F_y$$

$$S_{AF} = -\frac{\sqrt{l^2+b^2+h^2}}{h} A_z$$

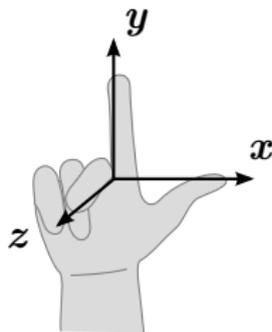
$$S_{AF} = -\frac{b}{\sqrt{l^2+b^2+h^2}} F_y$$

$$S_{AF} = \frac{h}{\sqrt{l^2+b^2+h^2}} A_z$$

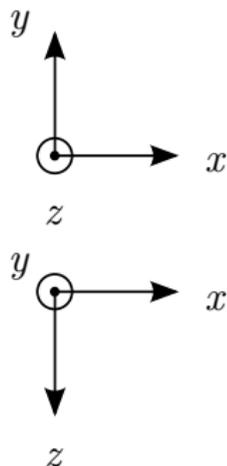




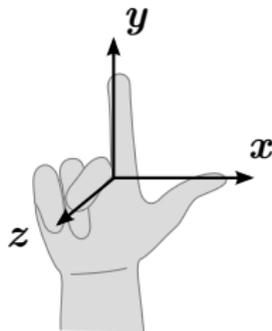
Rechte-Hand-Regel:



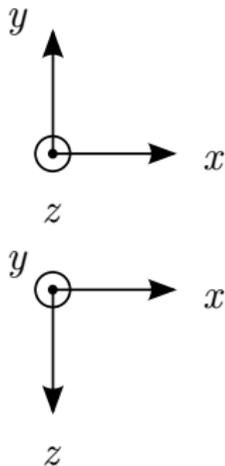
- Richtung des Kreuzproduktes



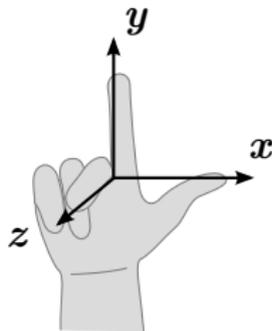
Rechte-Hand-Regel:



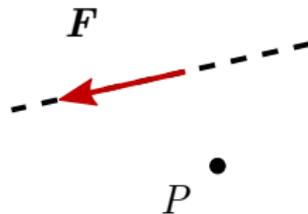
- Richtung des Kreuzproduktes
- Momentengleichgewicht



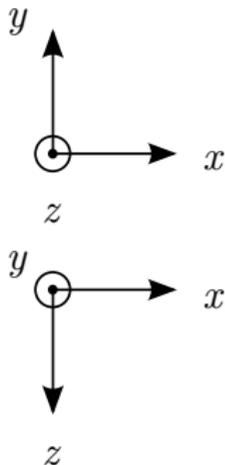
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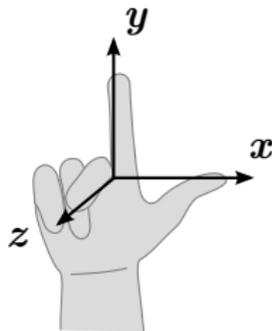
Für Momente:



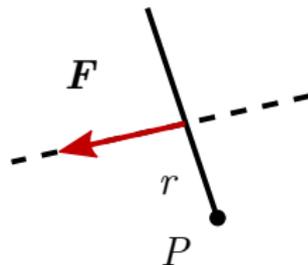
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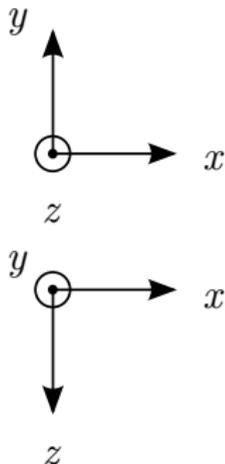
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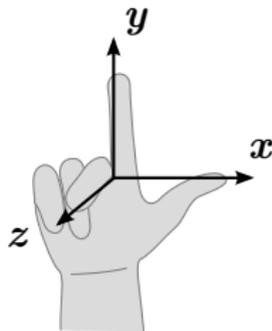
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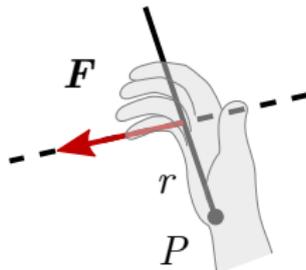
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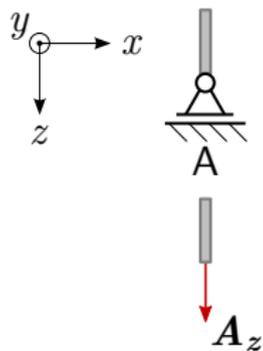


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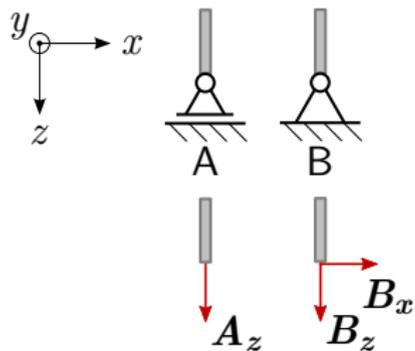


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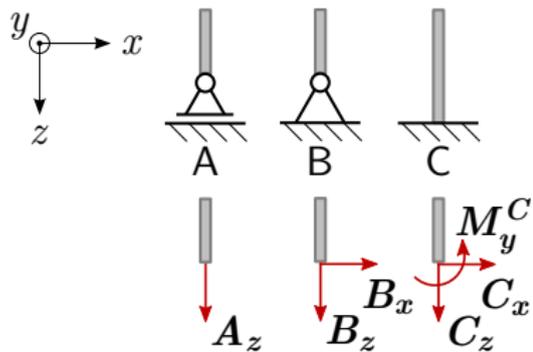
Lager



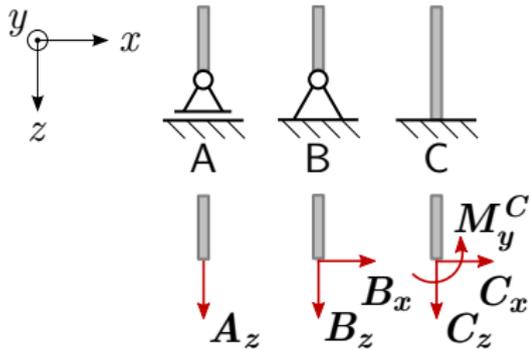
Lager



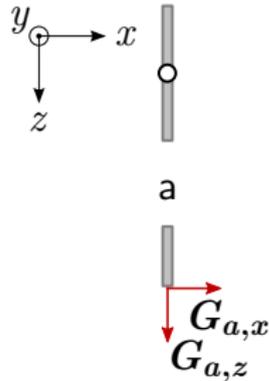
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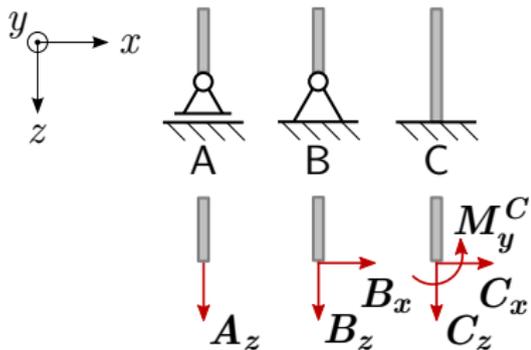
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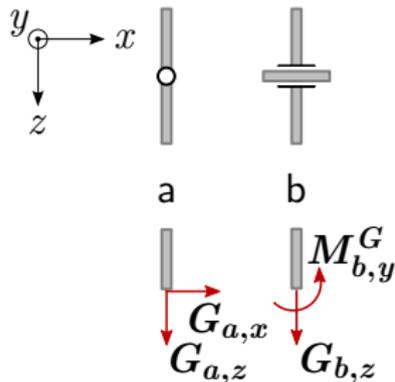
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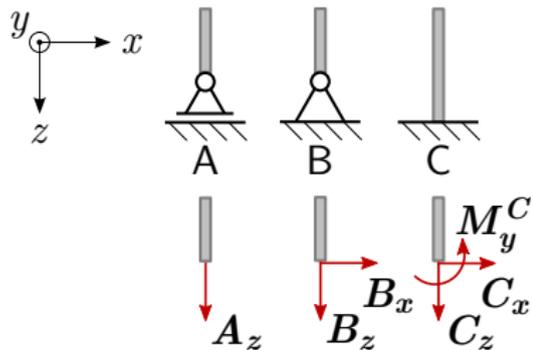
Lager



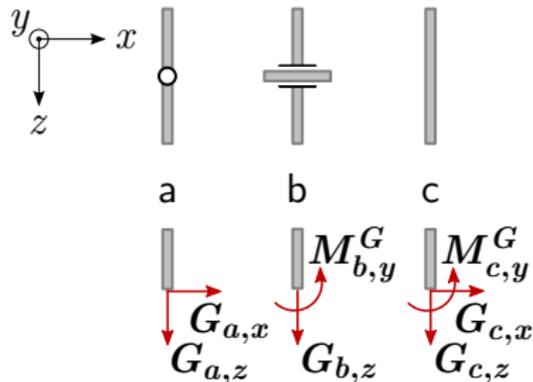
Gelenke



Lager



Gelenke



Statische Bestimmtheit:

mehr GGB als Lagerreaktionen	\Leftrightarrow	stat. unterbestimmt
mehr Lagerreaktionen als GGB	\Leftrightarrow	stat. überbestimmt

Bestimmtheit

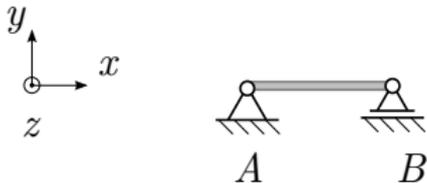
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Kinematische Bestimmtheit:

statisch unterbestimmt	\Leftrightarrow	kinematisch unterbestimmt
statisch überbestimmt	\Leftrightarrow	kinematisch bestimmt
statisch bestimmt	\Leftrightarrow	kinematisch bestimmt*

*Ausnahmen (2D):



Bestimmtheit

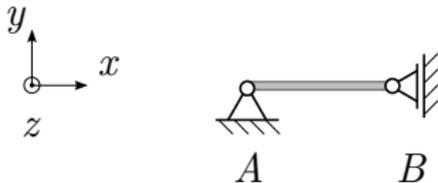
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statisch unterbestimmt	\Leftrightarrow	kinematisch unterbestimmt
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Bestimmtheit

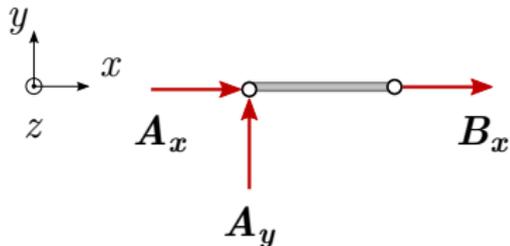
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statisch unterbestimmt	\Leftrightarrow	kinematisch unterbestimmt
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*Ausnahmen (2D):



Bestimmtheit

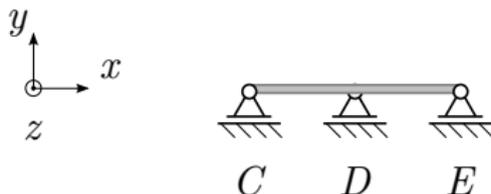
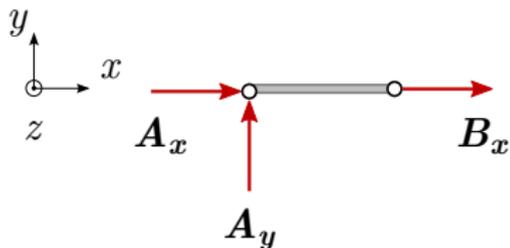
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Kinematische Bestimmtheit:

statisch unterbestimmt	\Leftrightarrow	kinematisch unterbestimmt
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Bestimmtheit

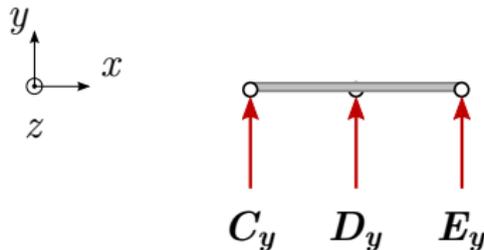
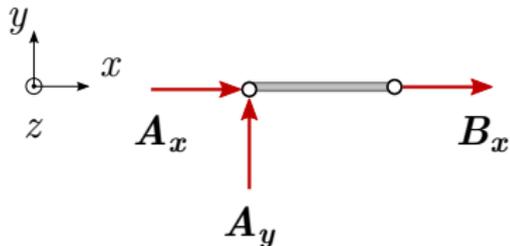
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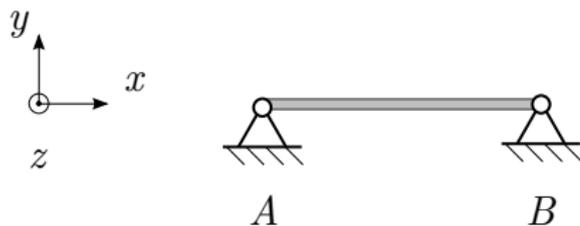
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Kinematische Bestimmtheit:

statisch unterbestimmt	\Leftrightarrow	kinematisch unterbestimmt
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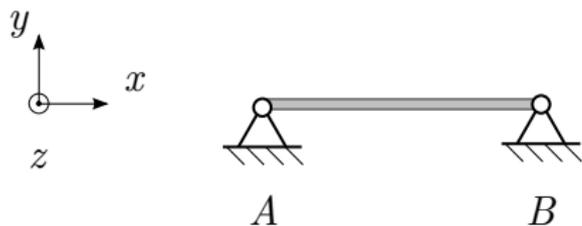


Was stimmt?

statisch bestimmt

kinematisch bestimmt

weder noch

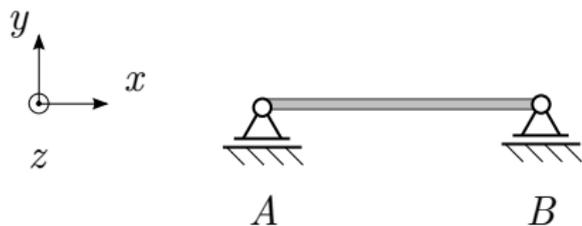


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statisch bestimmt

kinematisch bestimmt

weder noch

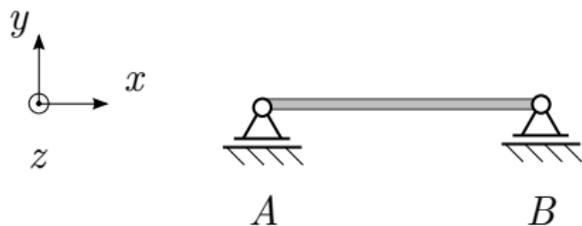


Was stimmt?

statisch bestimmt

kinematisch bestimmt

weder noch

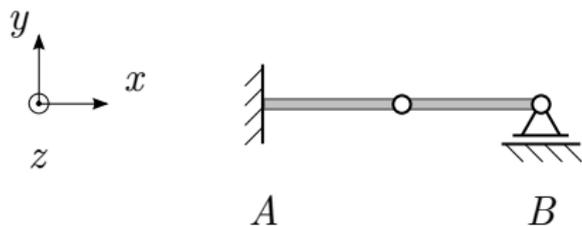


Was stimmt?

statisch bestimmt

kinematisch bestimmt

weder noch

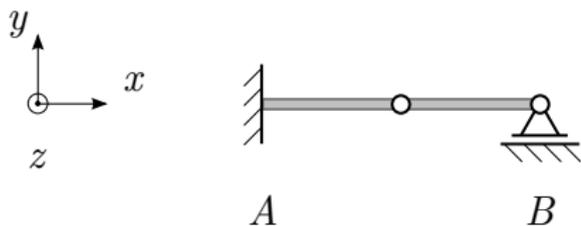


Was stimmt?

statisch bestimmt

kinematisch bestimmt

weder noch

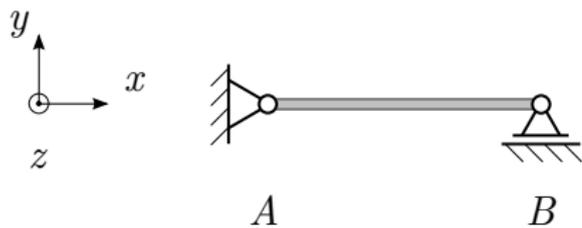


Was stimmt?

statisch bestimmt

kinematisch bestimmt

weder noch

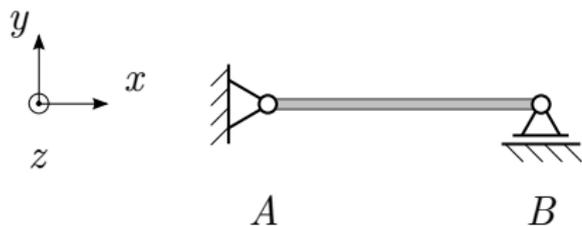


Was stimmt?

statisch bestimmt

kinematisch bestimmt

weder noch



Was stimmt?

statisch bestimmt

kinematisch bestimmt

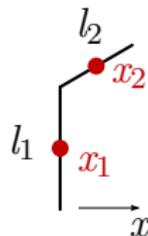
weder noch

$$x_s = \frac{\sum_i x_i G_i}{\sum_i G_i}$$

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Linien:

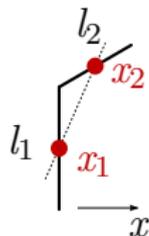
$$x_s = \frac{\sum_i x_i l_i}{\sum_i l_i}$$



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Linien:

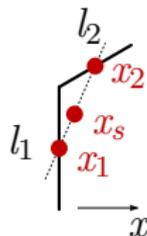
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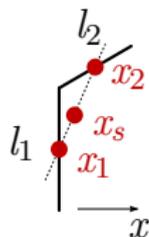


Schwerpunktsformel

$$x_s = \frac{\sum_i x_i G_i}{\sum_i G_i}$$

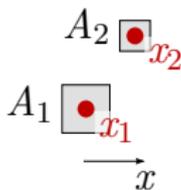
Linien:

$$x_s = \frac{\sum_i x_i l_i}{\sum_i l_i}$$



Flächen:

$$x_s = \frac{\sum_i x_i A_i}{\sum_i A_i}$$

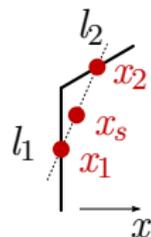


Schwerpunktsformel

$$x_s = \frac{\sum_i x_i G_i}{\sum_i G_i}$$

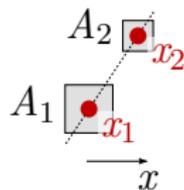
Linien:

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Flächen:

$$x_s = \frac{\sum_i x_i A_i}{\sum_i A_i}$$

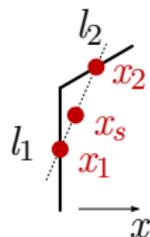


Schwerpunktsformel

$$x_s = \frac{\sum_i x_i G_i}{\sum_i G_i}$$

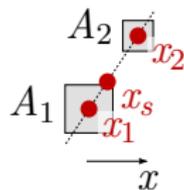
Linien:

$$x_s = \frac{\sum_i x_i l_i}{\sum_i l_i}$$

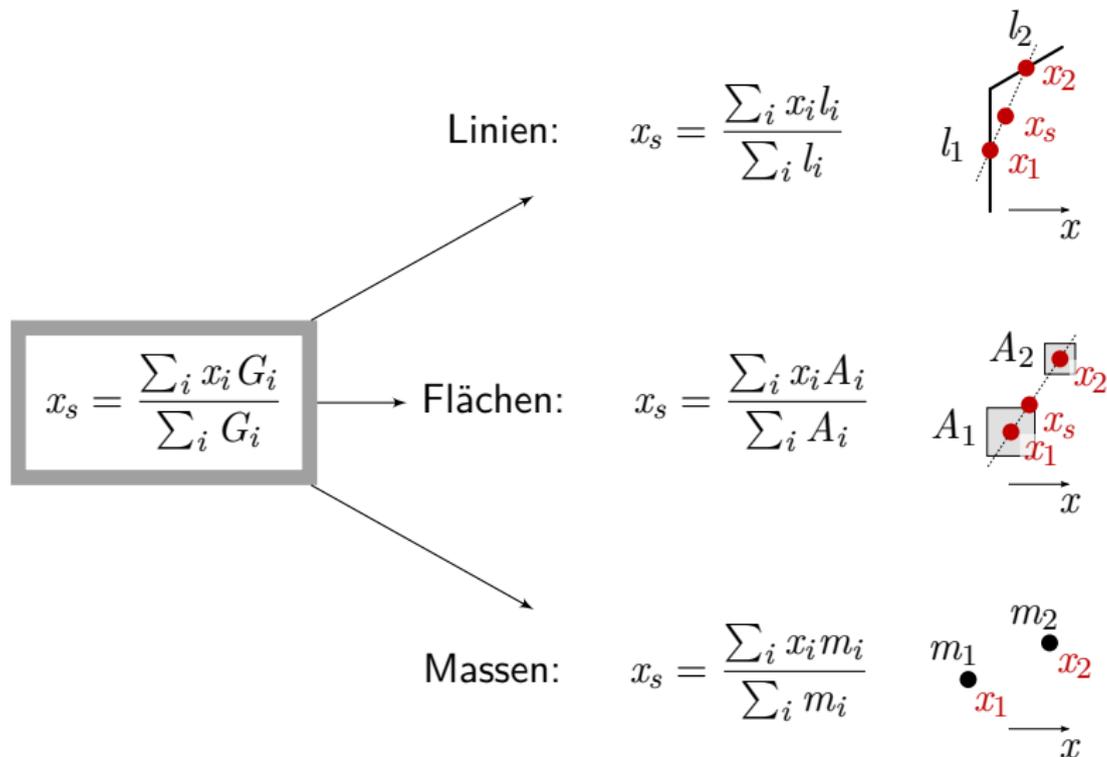


Flächen:

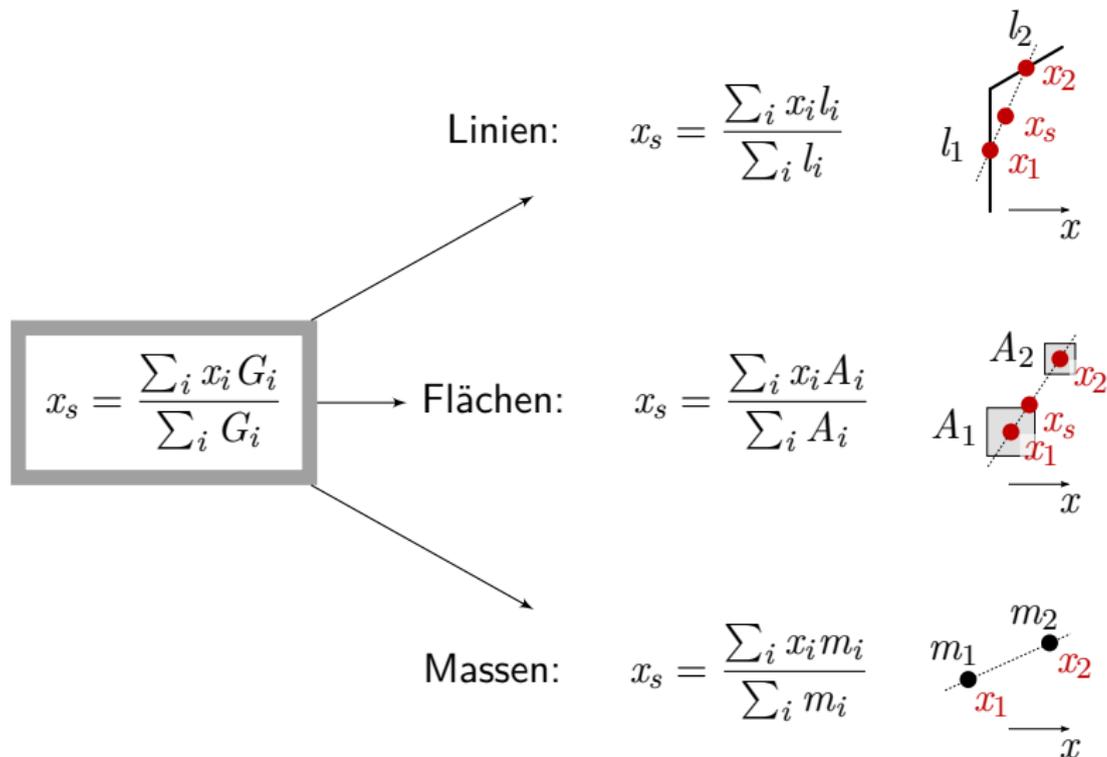
$$x_s = \frac{\sum_i x_i A_i}{\sum_i A_i}$$



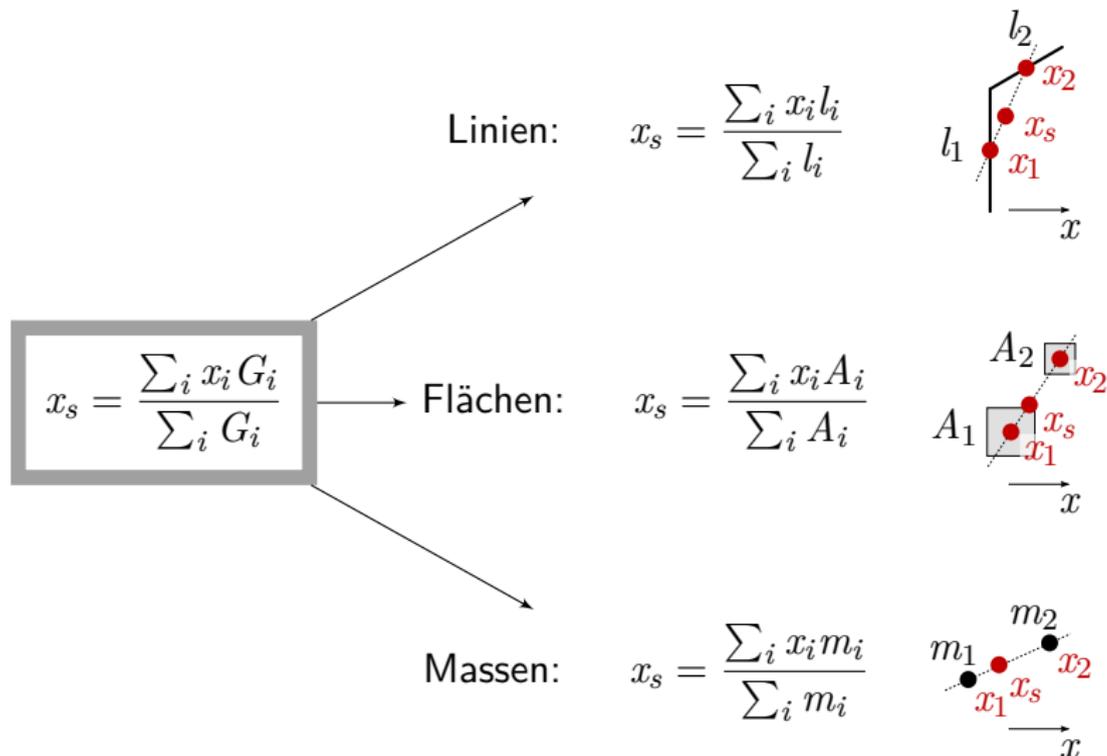
Schwerpunktsformel

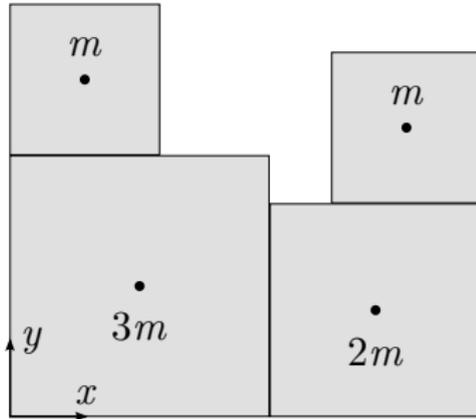


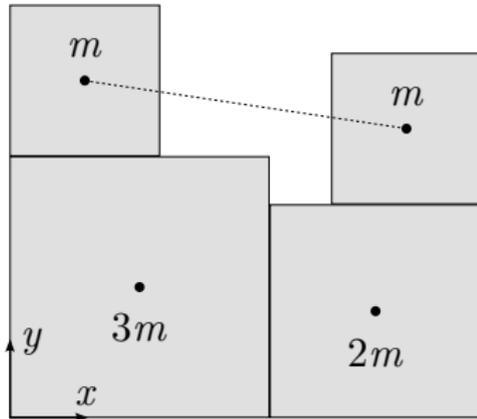
Schwerpunktsformel

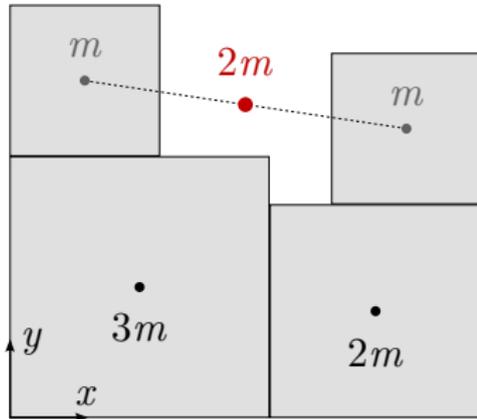


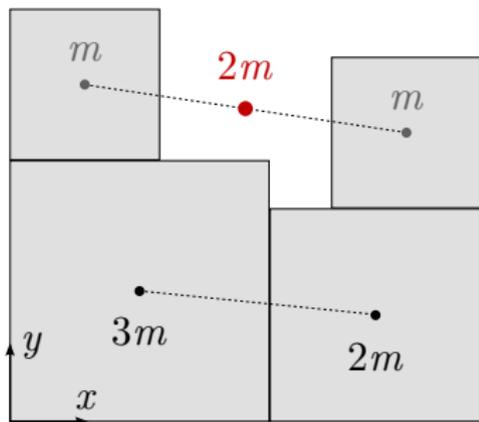
Schwerpunktsformel

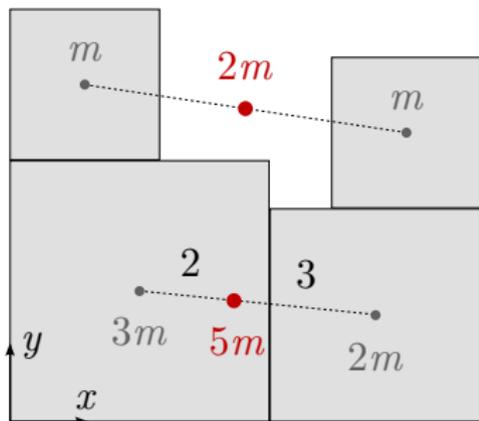


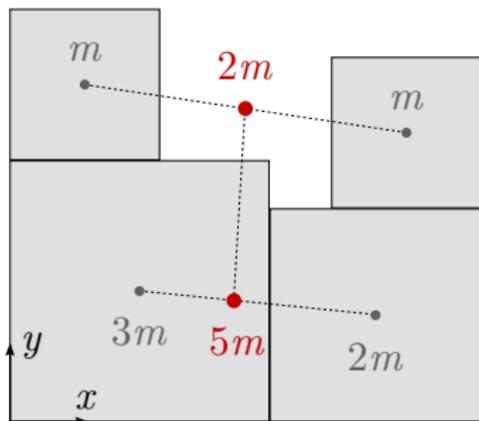


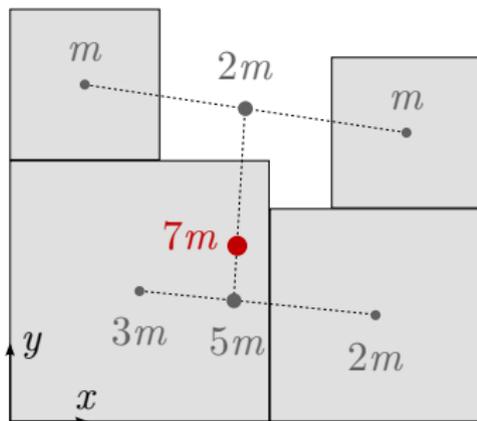


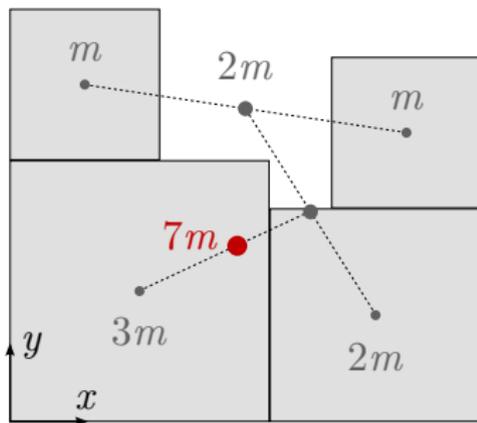




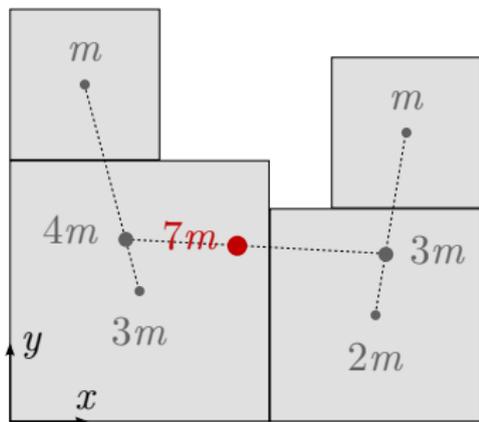


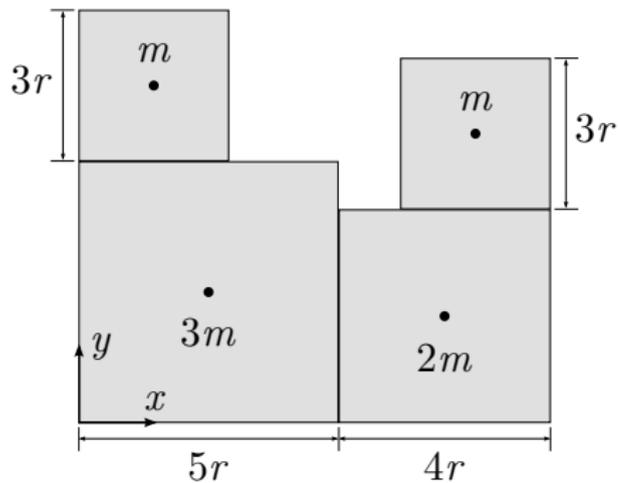


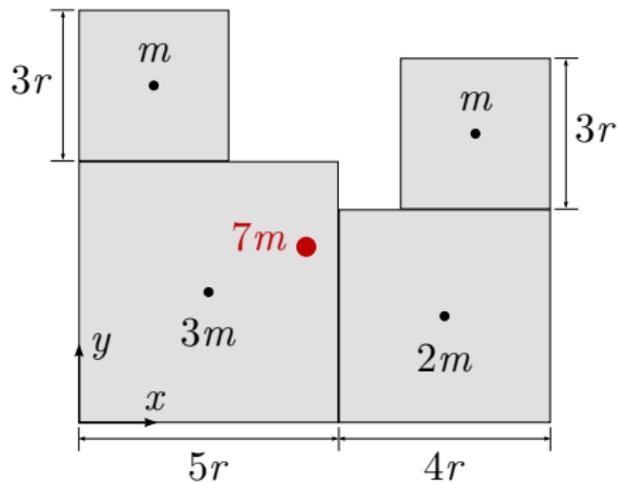




Schwerpunkte





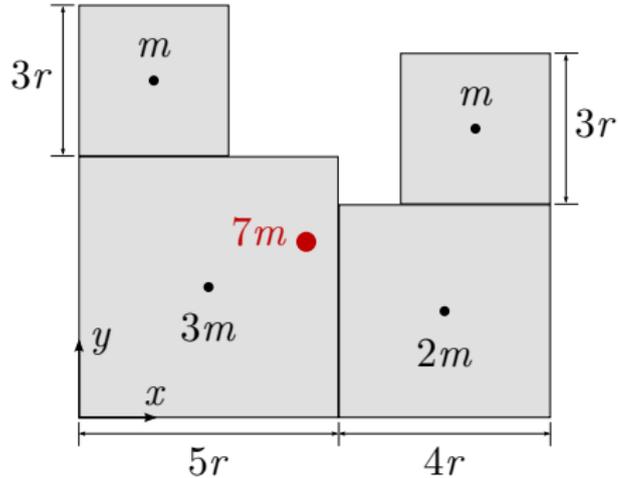


Was stimmt?

$$s_x = \frac{65}{14}r$$

$$s_x = \frac{63}{14}r$$

$$s_x = \frac{61}{14}r$$

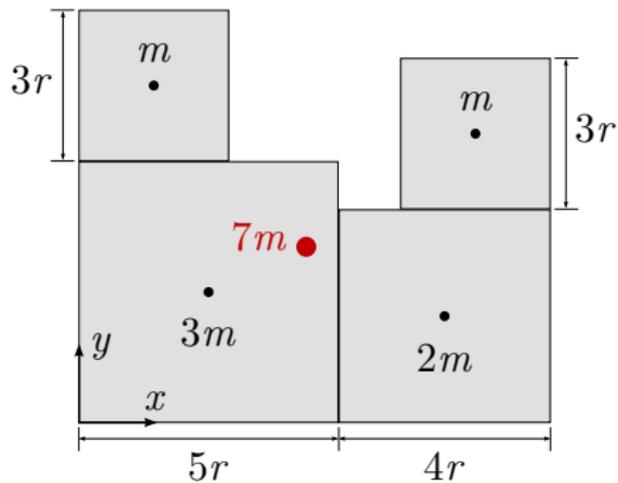


Was stimmt?

$$s_x = \frac{65}{14} r$$

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$$s_x = \frac{61}{14} r$$

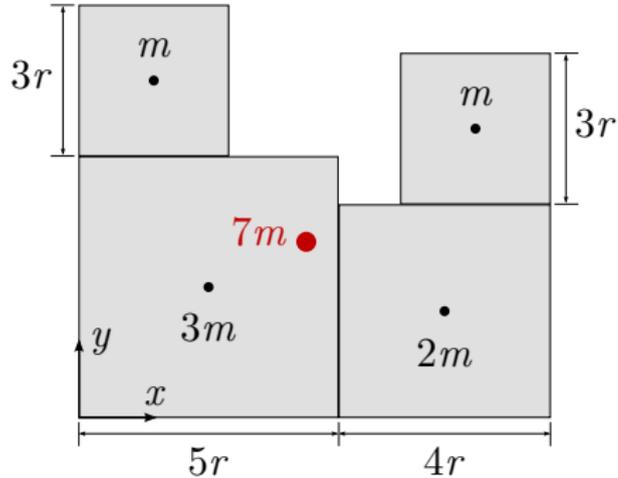


Was stimmt?

$$s_y = \frac{51}{14} r$$

$$s_y = \frac{49}{14} r$$

$$s_y = \frac{47}{14} r$$



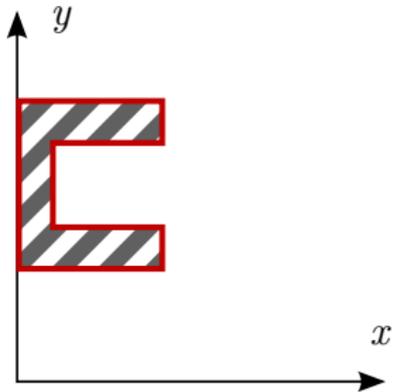
Was stimmt?

$$s_y = \frac{51}{14} r$$

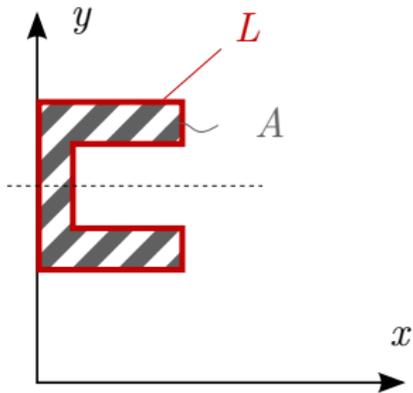
$$s_y = \frac{49}{14} r$$

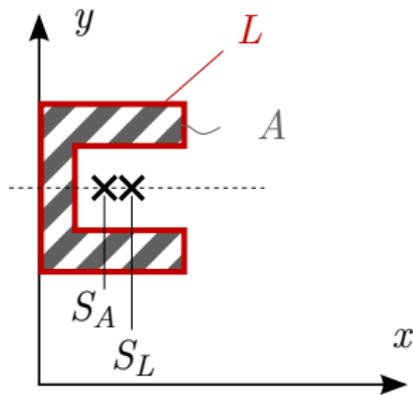
$$s_y = \frac{47}{14} r$$

Guldinsche Formeln



Guldinsche Formeln

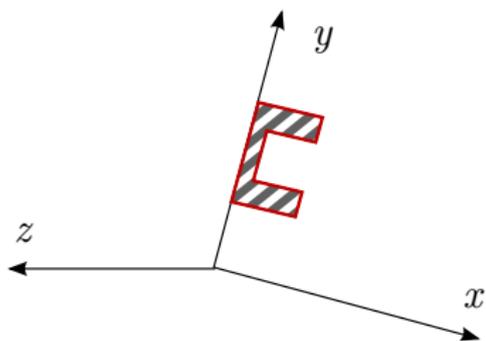




$$O_{\text{rot}} = 2\pi d_L L$$

$$V_{\text{rot}} = 2\pi d_A A$$

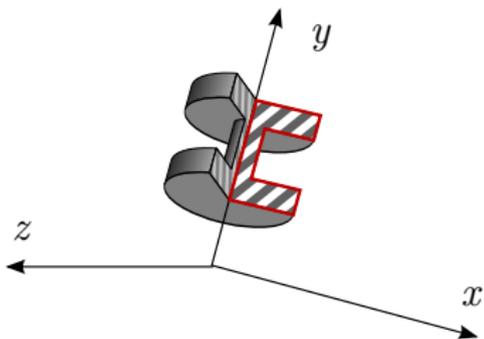
d_* ist der senkrechte Abstand von S_* zur Drehachse



$$O_{\text{rot}} = 2\pi d_L L$$

$$V_{\text{rot}} = 2\pi d_A A$$

d_* ist der senkrechte Abstand von S_* zur Drehachse

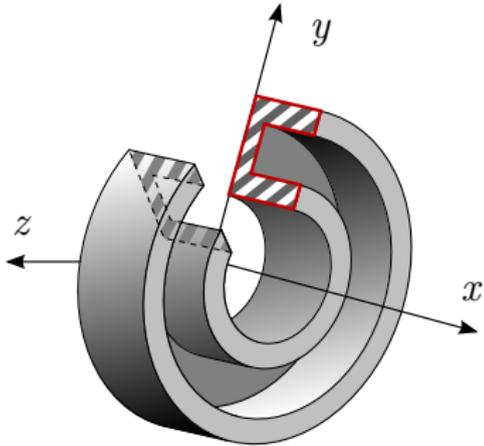


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Guldinsche Formeln



$$O_{\text{rot}} = 2\pi d_L L$$

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d_* ist der senkrechte Abstand von S_* zur Drehachse

Fragen?