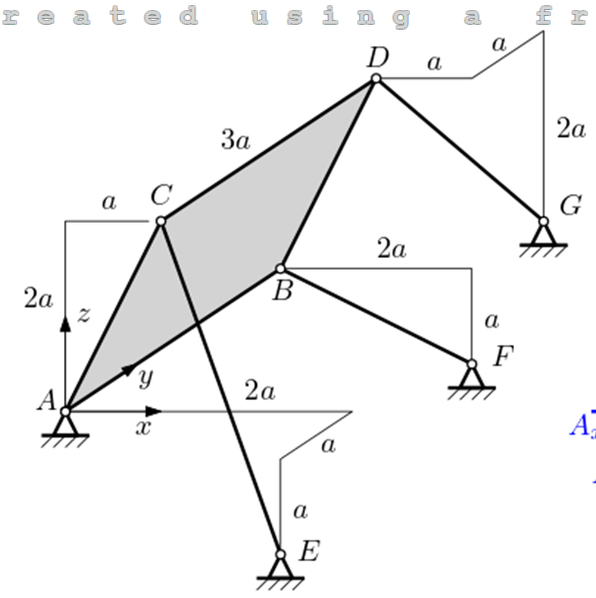

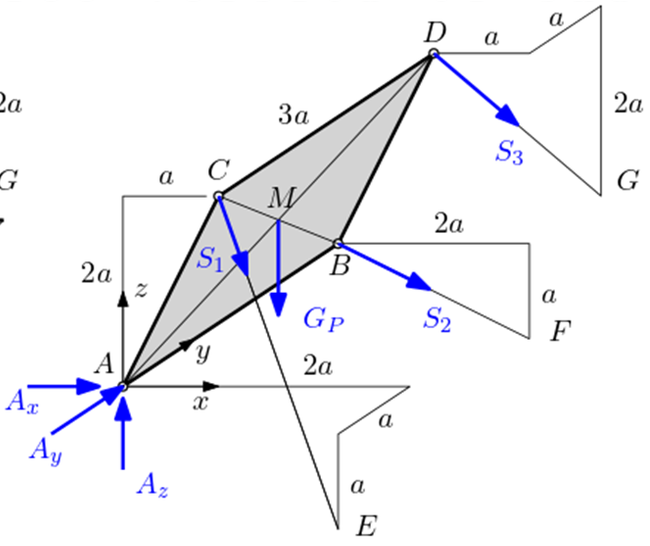

Punkte

A0102 #001

$$r_A := \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix} \quad r_B := \begin{bmatrix} 0 \\ 3 \cdot a \\ 0 \end{bmatrix} \quad r_C := \begin{bmatrix} a \\ 0 \\ 2 \cdot a \end{bmatrix} \quad r_D := \begin{bmatrix} a \\ 3 \cdot a \\ 2 \cdot a \end{bmatrix} \quad a := a_0$$

$$r_E := \begin{bmatrix} 3 \cdot a \\ -a \\ -a \end{bmatrix} \quad r_F := \begin{bmatrix} 2 \cdot a \\ 3 \cdot a \\ -a \end{bmatrix} \quad r_G := \begin{bmatrix} 2 \cdot a \\ 4 \cdot a \\ 0 \end{bmatrix} \quad r_M := \frac{1}{2} \cdot \left(r_D - r_A \right) = \begin{bmatrix} \frac{a}{2} \\ \frac{3 \cdot a}{2} \\ a \end{bmatrix}$$

483 x 165

"A0102"

$\text{assume}\left(a > 0\right) = \text{redundant}$

Modifications in sky blue

A0102 #002

$$F_M := \begin{bmatrix} 0 \\ 0 \\ -G_P \end{bmatrix} \quad F_A := \begin{bmatrix} A_x \\ A_y \\ A_z \end{bmatrix}$$

184 x 80

"A0102"

A0102 #003

$$e\left(v\right) := \left| \frac{v}{\sqrt{v \cdot v}} \right| \quad e\left(r_M\right) = \begin{bmatrix} 0.267 \\ 0.802 \\ 0.535 \end{bmatrix}$$

298 x 86

"A0102"

This seems to have issues with vectorize

$$e\left(\overrightarrow{v}\right) := \frac{\overrightarrow{v}}{\sqrt{v \cdot v}}$$

also, needs maxima to simplify sqrt(a^2)

Stabvektoren

A0102 #004

$$r_{BF} := r_F - r_B = \begin{bmatrix} 2 \cdot a \\ 0 \\ -a \end{bmatrix} \quad r_{CE} := r_E - r_C = \begin{bmatrix} 2 \cdot a \\ -a \\ -3 \cdot a \end{bmatrix} \quad r_{DG} := r_G - r_D = \begin{bmatrix} a \\ a \\ -2 \cdot a \end{bmatrix}$$

516 x 82

"A0102"

Stabkraftvektoren

A0102 #005

$$\vec{F_B} = \begin{bmatrix} \frac{2 \cdot S_2}{\sqrt{5}} \\ 0 \\ -\frac{S_2}{\sqrt{5}} \end{bmatrix} \qquad F_C = \begin{bmatrix} \frac{2 \cdot S_1}{\sqrt{14}} \\ -\frac{S_1}{\sqrt{14}} \\ -\frac{3 \cdot S_1}{\sqrt{14}} \end{bmatrix} \qquad F_D = \begin{bmatrix} \frac{S_3}{\sqrt{6}} \\ \frac{S_3}{\sqrt{6}} \\ -\frac{2 \cdot S_3}{\sqrt{6}} \end{bmatrix}$$

524 x 182

"A0102"

$forget(x\#) := \text{str2num}(\text{eval}(\text{num2str}(x\#)))$

Very ugly trick: helps for "forget" the definition, or "do" it or something else.

A0102 #006

Resultierende Kraft

$\Sigma F := F_A + F_B + F_C + F_D + F_M$

Resultierendes Moment

$\Sigma M_A := r_A \times F_A + r_B \times F_B + r_C \times F_C + r_D \times F_D + r_M \times F_M$

Gleichgewichtsbedingungen und unbekannte Lagerreaktionen

$GGB := forget(\text{stack}(\Sigma F, \Sigma M_A))$

$$R := \begin{bmatrix} A_x \\ A_y \\ A_z \\ S_1 \\ S_2 \\ S_3 \end{bmatrix}$$

Using lexical order looks better

448 x 196

"A0102"

A0102 #007

$$GGB_4 = \frac{a \cdot \left(2 \cdot \left(\left(-3 \cdot S_2 \cdot \sqrt{14} + 2 \cdot S_1 \cdot \sqrt{5}\right) \cdot \sqrt{6} - 8 \cdot S_3 \cdot \sqrt{14} \cdot \sqrt{5}\right) - 3 \cdot G_P \cdot \sqrt{6} \cdot \sqrt{14} \cdot \sqrt{5}\right)}{2 \cdot \sqrt{6} \cdot \sqrt{14} \cdot \sqrt{5}}$$

642 x 57

"A0102"

A0102 #008

$$\text{expandwrt}(GGB, S_1, S_2, S_3, A_x, A_z) = \begin{bmatrix} \frac{S_3}{\sqrt{6}} + \frac{2 \cdot S_2}{\sqrt{5}} + \frac{2 \cdot S_1}{\sqrt{14}} + A_x \\ \frac{S_3}{\sqrt{6}} - \frac{S_1}{\sqrt{14}} + A_y \\ -\frac{2 \cdot S_3}{\sqrt{6}} - \frac{S_2}{\sqrt{5}} - \frac{3 \cdot S_1}{\sqrt{14}} - G_P + A_z \\ -\frac{8 \cdot S_3 \cdot a}{\sqrt{6}} - \frac{3 \cdot S_2 \cdot a}{\sqrt{5}} + \frac{2 \cdot S_1 \cdot a}{\sqrt{14}} - \frac{3 \cdot G_P \cdot a}{2} \\ \frac{4 \cdot S_3 \cdot a}{\sqrt{6}} + \frac{\sqrt{14} \cdot S_1 \cdot a}{2} + \frac{G_P \cdot a}{2} \\ -\frac{2 \cdot S_3 \cdot a}{\sqrt{6}} - \frac{6 \cdot S_2 \cdot a}{\sqrt{5}} - \frac{S_1 \cdot a}{\sqrt{14}} \end{bmatrix}$$

$$GGB = \begin{bmatrix} \frac{\left(\left(A_x \cdot \sqrt{5} + 2 \cdot S_2\right) \cdot \sqrt{14} + 2 \cdot S_1 \cdot \sqrt{5}\right)}{\sqrt{6} \cdot \sqrt{14} \cdot \sqrt{5}} \\ \frac{\left(-S_1 + A_y \cdot \sqrt{14}\right) \cdot \sqrt{6}}{\sqrt{6} \cdot \sqrt{14}} \\ -\frac{\sqrt{6} \cdot \left(-\left(-S_2 + A_z \cdot \sqrt{5}\right) \cdot \sqrt{14} + 3 \cdot S_1 \cdot \sqrt{5} + \right.}{\sqrt{6} \cdot \sqrt{14} \cdot \sqrt{} \\ \frac{a \cdot \left(2 \cdot \left(\left(-3 \cdot S_2 \cdot \sqrt{14} + 2 \cdot S_1 \cdot \sqrt{5}\right) \cdot \sqrt{6} - 8 \cdot S_3 \cdot \right.\right.}{2 \cdot \sqrt{6} \cdot \sqrt{14} \cdot \sqrt{} \\ \frac{a \cdot \left(2 \cdot \left(7 \cdot S_1 \cdot \sqrt{6} + 4 \cdot S_3 \cdot \sqrt{14}\right.\right.}{2 \cdot \sqrt{6} \cdot \sqrt{14}} \\ -\frac{a \cdot \left(\left(6 \cdot S_2 \cdot \sqrt{14} + S_1 \cdot \sqrt{5}\right) \cdot \sqrt{6}\right.}{\sqrt{6} \cdot \sqrt{14} \cdot \sqrt{} \end{bmatrix}$$

355 x 300

"A0102"

A0102 #009

$M := \text{Jacob}(GGB, R)$ $y := M \cdot R - GGB$

$x := forget\left(M^{-1} \cdot y\right)$

$$\frac{\overrightarrow{x}}{G_P} = \begin{bmatrix} -0.0042 \\ 0.2415 \\ 0.7881 \\ 0.1585 \\ 0.1326 \\ -0.4878 \end{bmatrix}$$

$$M = \begin{bmatrix} 1 & 0 & 0 & \frac{2}{\sqrt{14}} & \frac{2}{\sqrt{5}} & \frac{1}{\sqrt{6}} \\ 0 & 1 & 0 & -\frac{1}{\sqrt{14}} & 0 & \frac{1}{\sqrt{6}} \\ 0 & 0 & 1 & -\frac{3}{\sqrt{14}} & -\frac{1}{\sqrt{5}} & -\frac{2}{\sqrt{6}} \\ 0 & 0 & 0 & \frac{2 \cdot a}{\sqrt{14}} & -\frac{3 \cdot a}{\sqrt{5}} & -\frac{8 \cdot a}{\sqrt{6}} \\ 0 & 0 & 0 & \frac{7 \cdot a}{\sqrt{14}} & 0 & \frac{4 \cdot a}{\sqrt{6}} \\ 0 & 0 & 0 & -\frac{a}{\sqrt{14}} & -\frac{6 \cdot a}{\sqrt{5}} & -\frac{2 \cdot a}{\sqrt{6}} \end{bmatrix} \quad \Sigma M(y) = \begin{bmatrix} 0 \\ 0 \\ G_P \\ \frac{3 \cdot G_P \cdot a}{2} \\ -\frac{G_P \cdot a}{2} \\ 0 \end{bmatrix}$$

336 x 209

"A0102"

A0102 #010

$L := \text{Assign}(\text{Solve}(GGB, R))$

$$\frac{1}{G_P} \cdot \begin{bmatrix} A_x \\ A_y \\ A_z \\ S_1 \\ S_2 \\ S_3 \end{bmatrix} = \begin{bmatrix} -0.0042 \\ 0.2415 \\ 0.7881 \\ 0.1585 \\ 0.1326 \\ -0.4878 \end{bmatrix}$$

396 x 162

"A0102"

Everything with Findroot

$G_P := 10\ \text{kN}$ $a := 1\ \text{m}$ $\text{Clear}(S_1, S_2, S_3, A_x, A_y, A_z, R) = 1$

$$\text{FindRoot}\left(GGB, \begin{bmatrix} A_x \\ A_y \\ A_z \\ S_1 \\ S_2 \\ S_3 \end{bmatrix} = 1\ \text{N}\right) = \begin{bmatrix} -42.4 \\ 2420 \\ 7880 \\ 1590 \\ 1330 \\ -4880 \end{bmatrix} \text{N}$$

A0102 #011

$a := 1\ \text{m}$ $G_P := 10\ \text{kN}$

160 x 30

$\text{Clear}(S_1, S_2, S_3, A_x, A_y, A_z) = 1$

"A0102"

A0102 #012

$$r_A := \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix} \quad r_B := \begin{bmatrix} 0 \\ 3 \cdot a \\ 0 \end{bmatrix} \quad r_C := \begin{bmatrix} a \\ 0 \\ 2 \cdot a \end{bmatrix} \quad r_D := \begin{bmatrix} a \\ 3 \cdot a \\ 2 \cdot a \end{bmatrix}$$

$$r_E := \begin{bmatrix} 3 \cdot a \\ -a \\ -a \end{bmatrix} \quad r_F := \begin{bmatrix} 2 \cdot a \\ 3 \cdot a \\ -a \end{bmatrix} \quad r_G := \begin{bmatrix} 2 \cdot a \\ 4 \cdot a \\ 0 \end{bmatrix} \quad r_M := \frac{1}{2} \cdot \left(r_D - r_A\right) = \begin{bmatrix} 0.5\ \text{m} \\ 1.5\ \text{m} \\ 1\ \text{m} \end{bmatrix}$$

477 x 130

"A0102"

A0102 #013

$$F_M := \begin{bmatrix} 0 \\ 0 \\ -G_P \end{bmatrix} \qquad F_A := \begin{bmatrix} A_x \\ A_y \\ A_z \end{bmatrix}$$

184 x 80

"A0102"

A0102 #014

$$e(v) := \left| \begin{array}{l} n\# := \sqrt{v \cdot v} \\ \dfrac{v}{n\#} \end{array} \right. \qquad e(r_M) = \begin{bmatrix} 0.267 \\ 0.802 \\ 0.535 \end{bmatrix}$$

278 x 64

"A0102"

Using this e enable further vectorization

Stabvektoren

A0102 #015

$$r_{BF} := r_F - r_B = \begin{bmatrix} 2 \\ 0 \\ -1 \end{bmatrix} \text{m} \quad r_{CE} := r_E - r_C = \begin{bmatrix} 2 \\ -1 \\ -3 \end{bmatrix} \text{m} \quad r_{DG} := r_G - r_D = \begin{bmatrix} 1 \\ 1 \\ -2 \end{bmatrix} \text{m}$$

510 x 63

"A0102"

Stabkraftvektoren

A0102 #016

$$F_B := \overrightarrow{e(r_F - r_B) \cdot S_2} \qquad F_C := \overrightarrow{e(r_E - r_C) \cdot S_1} \qquad F_D := \overrightarrow{e(r_G - r_D) \cdot S_3}$$

$$F_B = \begin{bmatrix} \dfrac{200000000000000 \cdot S_2}{223606797749979} \\ 0 \\ -\dfrac{S_2}{2.23606797749979} \end{bmatrix} \quad F_C = \begin{bmatrix} \dfrac{2 \cdot S_1}{\sqrt{14}} \\ -\dfrac{S_1}{\sqrt{14}} \\ -\dfrac{3 \cdot S_1}{\sqrt{14}} \end{bmatrix} \quad F_D = \begin{bmatrix} \dfrac{S_3}{\sqrt{6}} \\ \dfrac{S_3}{\sqrt{6}} \\ -\dfrac{2 \cdot S_3}{\sqrt{6}} \end{bmatrix}$$

499 x 178

"A0102"

this horrible F.B is because e(V) without maxima.

A0102 #017

Resultierende Kraft

$$\Sigma F := F_A + F_B + F_C + F_D + F_M$$

Resultierendes Moment

$$\Sigma M_A := r_A \times F_A + r_B \times F_B + r_C \times F_C + r_D \times F_D + r_M \times F_M \qquad R := \begin{bmatrix} A_x \\ A_y \\ A_z \\ S_1 \\ S_2 \\ S_3 \end{bmatrix}$$

Gleichgewichtsbedingungen und unbekannte Lagerreaktionen

$$GGB := forget\left(\text{stack}\left(\Sigma F, \Sigma M_A\right)\right)$$

448 x 180

"A0102"

$$sol := \text{roots}\left(\left| \begin{array}{l} [\text{m} := 1 \ \text{kg} := 1 \ \text{s} := 1], R \\ GGBX := GGB \end{array} \right.\right) \text{N} = \begin{bmatrix} -42.3729 \\ 2415.2542 \\ 7881.3559 \\ 1585.448 \\ 1326.481 \\ -4878.2211 \end{bmatrix} \text{N}$$

$$GGB\left|_{sol}^{\rightarrow}\right. = \begin{bmatrix} -1.9986 \cdot 10^{-12} \\ -3.9694 \cdot 10^{-12} \\ 4.0806 \cdot 10^{-12} \\ 1.1361 \cdot 10^{-11} \text{ m} \\ -7.9387 \cdot 10^{-12} \text{ m} \end{bmatrix} \text{N}$$

([A = 1 N])

$$\text{FindRoot}\left(GGB, \begin{bmatrix} A_y = 1\ \text{N} \\ A_z = 1\ \text{N} \\ S_1 = 1\ \text{N} \\ S_2 = 1\ \text{N} \\ S_3 = 1\ \text{N} \end{bmatrix}\right) = \begin{bmatrix} -42.4 \\ 2420 \\ 7880 \\ 1590 \\ 1330 \\ -4880 \end{bmatrix}\ \text{N}$$

$$GGB = \begin{bmatrix} 1.4593 \cdot 10^{-11} \\ 1.9966 \cdot 10^{-11} \\ -2.294 \cdot 10^{-11} \\ -1.0689 \cdot 10^{-10}\ \text{m} \\ -1.3496 \cdot 10^{-11}\ \text{m} \\ -9.0143 \cdot 10^{-11}\ \text{m} \end{bmatrix}\ \text{N}$$

$$\begin{bmatrix} 2.2485 \cdot 10^{-12}\ \text{m} \end{bmatrix}$$

$$\text{appVersion}(4) = \text{"1.0.8348.30405"}$$