Evaluating a Formula like in a Texbook

Evals

Sintaxis

$Evals(eq, values, n, u)$	Try to show eq at values with n decimals in the unit u as in a textbook.
$Evals(eq, values, n)$	For equations without units
$Evals(eq, values)$	Uses the decimals in the values, with a maximun of 6 (n=-1).
$Evals(v, eq, values, n, u)$	Assign to v the result of the equation.

- For specify units in values, use ~ as first character, instead '
- If the equation have constants with decimals, mask it with v2s
- The order of the values is the lexical order, given by Unknows(eq)

Example

$$E := Evals\left(\frac{a\cdot c+b\cdot \cos(c)}{c^2+v2s(500.37)}, \begin{bmatrix}194400 & 44640 & \frac{5\cdot \pi}{12}\end{bmatrix}\right)$$

Using maximun 6 decimals

$$E = \left[\frac{a\cdot c+b\cdot \cos(c)}{500.37+c^2} = \frac{194400.\cdot 1.308997+44640.\cdot \cos(1.308997)}{500.37+1.308997^2} = \frac{266022.696343}{502.083473} = 529.837588\right]$$

Example

$$E := Evals\left(\frac{a\cdot c+b\cdot \cos(c)}{c^2+v2s(500.37)}, \begin{bmatrix}194400 & 44640 & \frac{5\cdot \pi}{12}\end{bmatrix}, 3\right)$$

Using 3 decimals for all numbers in values.

$$E = \left[\frac{a\cdot c+b\cdot \cos(c)}{500.370+c^2} = \frac{194400.000\cdot 1.309+44640.000\cdot \cos(1.309)}{500.370+1.309^2} = \frac{266023.150}{502.083} = 529.838\right]$$

Example

If the output is too long, it could be arranged into a table. Convertion factors use 6 dedimals.

$$E := Evals\left(\frac{a\cdot c+b\cdot \cos(c)}{c^2+v2s(500.37)}, \begin{bmatrix}0.18\cdot \frac{\mathbf{in}}{\mathbf{s}^2} & 12.4\cdot \frac{\mathbf{ft}}{\mathbf{min}^2} & 75\cdot \mathbf{deg}\end{bmatrix}, 3, \frac{\mathbf{ft}}{\mathbf{hr}^2}\right)$$

$$\frac{a\cdot c+b\cdot \cos(c)}{500.370+c^2}$$

$$= \frac{0.180\cdot \mathbf{in}\cdot 75.000\cdot \mathbf{deg}\cdot \mathbf{min}^2+12.400\cdot \mathbf{ft}\cdot \cos(75.000\cdot \mathbf{deg})\cdot \mathbf{s}^2}{\mathbf{min}^2\cdot \mathbf{s}^2\cdot (500.370+75.000^2\cdot \mathbf{deg}^2)}$$

$$= \frac{0.180\cdot 0.0254\cdot 75.000\cdot 0.017453\cdot 60.^2+12.400\cdot 0.3048\cdot \cos(75.000\cdot 0.017453)}{60.^2\cdot (500.370+75.000^2\cdot 0.017453^2)} \frac{12960000.}{0.3048} \frac{\mathbf{ft}}{\mathbf{hr}^2}$$

$$= 529.838\cdot \left[\frac{\mathbf{ft}}{\mathbf{hr}^2}\right]$$

stack(["" E1 "" ""], [E2 E3 "" ""], [E4 E5 E6 E7], [E8 E9·[E10] "" ""])

Example

$$E := Evals\left(\frac{2\cdot m_1\cdot m_2}{m_1+m_2}\cdot g_e, \begin{bmatrix}9.8\cdot \frac{\mathbf{m}}{\mathbf{s}^2} & 17.3\cdot \mathbf{lb} & 12.4\cdot \mathbf{lb}\end{bmatrix}, 2, \mathbf{lbf}\right)$$

$$E = \left[\frac{2\cdot m_1\cdot m_2\cdot g_e}{m_1+m_2} = \frac{2\cdot 17.30\cdot \mathbf{lb}\cdot 12.40\cdot 9.80\cdot \mathbf{m}}{(17.30+12.40)\cdot \mathbf{s}^2} = \frac{2\cdot 17.30\cdot 0.453592\cdot 12.40\cdot 9.80}{17.30+12.40} \frac{1}{4.448222} \mathbf{lbf} = 14.44\ \mathbf{lbf}\right]$$

$$\frac{2 \cdot m_1 \cdot m_2 \cdot g_e}{m_1 + m_2} = \frac{2 \cdot 17.30 \cdot \mathbf{lb} \cdot 12.40 \cdot 9.80 \cdot \mathbf{m}}{(17.30 + 12.40) \cdot \mathbf{s}^2} = \frac{2 \cdot 17.30 \cdot 0.453592 \cdot 12.40 \cdot 9.80}{17.30 + 12.40} \frac{1}{4.448222} \mathbf{lbf} = 14.44\ \mathbf{lbf}$$

E

Example For the 5 args version, first argument is the variable name to be assigned the result.

$$v_2 = \frac{a \cdot c + b \cdot \cos(c)}{500.370 + c^2} = \frac{194400.000 \cdot 1.309 + 44640.000 \cdot \cos(1.309)}{500.370 + 1.309^2} = \frac{266023.150}{502.083} = 529.838$$ Symbolic

$$\mathrm{Evals}\left(v_2, \frac{a \cdot c + b \cdot \cos(c)}{c^2 + \mathrm{v2s}(500.37)}, \left[194400\ 44640\ \frac{5 \cdot \pi}{12}\right], 3, 1\right)$$ $v_2 = 529.838$ Numerical

$$E := \mathrm{Evals}\left(T, \frac{2 \cdot m_1 \cdot m_2}{m_1 + m_2} \cdot g_e, \left[9.81 \cdot \frac{\mathbf{m}}{\mathbf{s}^2}\ 17.3 \cdot \mathbf{lb}\ 12.4 \cdot \mathbf{lb}\right], 2, \mathbf{lbf}\right)$$ $T = 14.45\ \mathrm{lbf}$

$$T = \frac{2 \cdot m_1 \cdot m_2 \cdot g_e}{m_1 + m_2}$$

$$= \frac{2 \cdot 17.30 \cdot \mathbf{lb} \cdot 12.40 \cdot 9.81 \cdot \mathbf{m}}{(17.30 + 12.40) \cdot \mathbf{s}^2}$$

$$= \frac{2 \cdot 17.30 \cdot 0.453592 \cdot 12.40 \cdot 9.81}{17.30 + 12.40} \frac{1}{4.448222} \mathbf{lbf}$$

$$= 14.45 \cdot [\mathbf{lbf}]$$

$$\mathrm{stack}\left(\left[\text{""}\ E_1\ \text{""}\ \text{""}\right], \left[E_2\ E_3\ \text{""}\ \text{""}\right], \left[E_4\ E_5\ E_6\ E_7\right], \left[E_8\ E_9 \cdot \left[E_{10}\right]\ \text{""}\ \text{""}\right]\right)$$ $\mathrm{Clear}(T) = 1$

Example Using uncertainties in the values: g.e is assuming exact, meanwhile the masses have errors.

$$E := \mathrm{Evals}\left(T, \frac{2 \cdot m_1 \cdot m_2}{m_1 + m_2} \cdot g_e, \left[9.81 \cdot \frac{\mathbf{m}}{\mathbf{s}^2}\ (17.3 \pm 0.1) \cdot \mathbf{lb}\ (12.4 \pm 0.2) \cdot \mathbf{lb}\right], 1, \mathbf{lbf}\right)$$ $T = \begin{cases} 14.6 \\ 14.3 \end{cases} \mathrm{lbf}$

$$T = \left(\frac{2 \cdot m_1 \cdot m_2 \cdot g_e}{m_1 + m_2}\right) + \pm \left(\left|\frac{2 \cdot m_2^2 \cdot g_e}{(m_1 + m_2)^2}\right| \cdot \Delta m_1 + \left|\frac{2 \cdot m_1^2 \cdot g_e}{(m_1 + m_2)^2}\right| \cdot \Delta m_2\right)$$

$$= \left(\frac{2 \cdot 17.3 \cdot \mathbf{lb} \cdot 12.4 \cdot 9.8 \cdot \mathbf{m}}{(17.3 + 12.4) \cdot \mathbf{s}^2}\right) + \pm \left(\mathbf{lb} \cdot \left(\left|\frac{2 \cdot 12.4^2 \cdot 9.8 \cdot \mathbf{m}}{(17.3 + 12.4)^2 \cdot \mathbf{s}^2}\right| \cdot 0.1 + \left|\frac{2 \cdot 17.3^2 \cdot 9.8 \cdot \mathbf{m}}{(17.3 + 12.4)^2 \cdot \mathbf{s}^2}\right| \cdot 0.2\right)\right)$$

$$= \frac{\left(\left(\frac{2 \cdot 17.3 \cdot 0.453592 \cdot \mathbf{kg} \cdot 12.4 \cdot 9.8 \cdot \mathbf{m}}{(17.3 + 12.4) \cdot \mathbf{s}^2}\right) + \pm \left(0.453592 \cdot \mathbf{kg} \cdot \left(\left|\frac{2 \cdot 12.4^2 \cdot 9.8 \cdot \mathbf{m}}{\mathbf{s}^2 \cdot (17.3 + 12.4)^2}\right| \cdot 0.1 + \left|\frac{2 \cdot 17.3^2 \cdot 9.8 \cdot \mathbf{m}}{\mathbf{s}^2 \cdot (17.3 + 12.4)^2}\right| \cdot 0.2\right)\right)\right) \cdot \mathbf{s}^2}{\mathbf{kg} \cdot \mathbf{m}} \frac{1}{4.448222} \mathbf{lbf}$$

$$= \begin{matrix} 14.6 \cdot \mathbf{lbf} \\ 14.3 \cdot \mathbf{lbf} \end{matrix}$$

Example Modifiying the output

$$Ev(n\#) := \begin{array}{|l} [\,U\# := \text{Unknowns}(eq)\;\; q\# := \text{length}(eq)\,] \\ \text{str2num}\left(\text{concat}\left(\text{strrep}\left(\text{num2str}\left(\text{Unknowns}(eq)\right), \text{"mat(", "Clear("}\right)\right)\right) \\ \left[\,V\# := U\#\;\; Q\# := \text{str2num}\left(\text{strrep}\left(\text{strrep}\left(\text{num2str}(eq), \text{":", "≡"}\right), \text{"'", "\textasciitilde"}\right)\right)\right] \\ \text{for } k\# \in [1..\text{length}(U\#)] \\ \quad Q\# := \text{str2num}\left(\text{concat}\left(\text{"equrep(Q\#,"}, \text{num2str}\left(U\#_{k\#}\right), \text{", "}, \text{num2str}\left(U\#_{k\#}\right), \text{")"}\right)\right) \\ \text{for } k\# \in [1..\text{length}(U\#)] \\ \quad V\# := \text{str2num}\left(\text{concat}\left(\text{"equrep(V\#,"}, \text{num2str}\left(U\#_{k\#}\right), \text{", "}, \text{num2str}\left(U\#_{k\#}\right), \text{")"}\right)\right) \\ Evals\left(V\#\big|_{Q\#_{q\#-1}}, V\#\big|_{Q\#_{[1..(q\#-2)]}}, n\#, V\#\big|_{Q\#_{q\#}}\right)_{[1\;2\;3\;8\;9\;10]^{T}} \end{array}$$

Enclose the definitions into a Mathcad block with eq as output. Let the two last as the main equation and the units.

$$a := 5.7\ \text{ft} \qquad b := 3\ \text{m} \qquad c := 3\ \text{lbf}$$

$$d := \frac{c}{a+b} \qquad unit := \frac{\text{lbf}}{\text{ft}}$$

eq

$d = 0.193\ \frac{\text{lbf}}{\text{ft}}$ things works as usual, but eq now is holded

$$Ev(4) = \left[\ \frac{c}{a+b} = \frac{3.0000 \cdot \text{lbf}}{5.7000 \cdot \text{ft} + 3.0000 \cdot \text{m}} = 0.1930\ \frac{\text{lbf}}{\text{ft}}\ \right]$$

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