A very very short CalcTEX introduction for very very impatients

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http://sg.bzip.pl/CalcTeX

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Outline

What is CalcTEX?

CalcTEX is a very simply package for calculation by mean of solver – currently `python` & based on TEX & LATEX standard. For CalcTEX calculation is quite supportive a basic knowledge of TEX or LATEX, `python` knowledge in not necessary. For calculation are using following TEX/LATEX environmental:

```
$ ... $
\[ ... \]
\begin{equation} ... \end{equation}
```

where ... means: variables, variables definition and actions.
For definition is using ":=" and for quotation is "..."
Example:

Source ..... Effect

`$ a:=\frac{1.2}{3^{4.5}}\cdot 6+\sqrt[7]{8.9} $` definition of "a"

value ..... $a := \frac{1.2}{3^{4.5}} \cdot 6 + \sqrt[7]{8.9}$

`$ a $` printing of "a" value ..... $a = 1.41787511296$

Values definition & printing

CalcTEX Sources – Example – 'ex01.tex'

pdf Effect

Values definition & printing

CalcTEX Sources – Example – 'ex01.tex'

```
This is a \TeX\ text ...  in eq.  \eqref{bdef}
```

pdf Effect

This is a TEX text ... in eq. (1)

Values definition & printing

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This is a \TeX\ text ...  in eq.  \eqref{bdef}
$
                    %begin of CalcTEX calculation env.
```

pdf Effect

This is a TEX text ... in eq. (1)

Values definition & printing

CalcTEX Sources – Example – 'ex01.tex'

```
This is a \TeX\ text ...  in eq.  \eqref{bdef}
$\alpha := \pi/2 $  % -- definition of α value

%end of CalcTEX calculation env.
```

pdf Effect

This is a TEX text ... in eq. (1) $\alpha := \pi/2$

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$\alpha := \pi/2 $  % -- definition of α value
\begin{equation} %begin of CalcTEX calculation env.
b:=\sin( \alpha) % definition of b value
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This is a TEX text ... in eq. (1) $\alpha := \pi/2$

$$b := \sin(\alpha) \qquad (1)$$

Values definition & printing

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"\label{bdef}" % quotation - no calculation env.
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\[ c:=\cos(\alpha) \] % def.  of c value
```

pdf Effect

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"\label{bdef}" % quotation - no calculation env.
\end{equation} %end of CalcTEX calculation env.
\[ c:=\cos(\alpha) \] % def.  of c value
$ \alpha/\pi $ % printing α/π value
```

pdf Effect

This is a TEX text ... in eq. (1) $\alpha := \pi/2$

$$b := \sin(\alpha) \qquad (1)$$

$$c := \cos(\alpha)$$

$\alpha/\pi = 0.5$

Values definition & printing

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\[ c:=\cos(\alpha) \] % def.  of c value
$ \alpha/\pi $ % printing α/π value
$ b^2+c^2 $ % -- printing:  b^2 + c^2 value
```

pdf Effect

This is a TEX text ... in eq. (1) $\alpha := \pi/2$

$$b := \sin(\alpha) \qquad (1)$$

$$c := \cos(\alpha)$$

$\alpha/\pi = 0.5$

$b^2 + c^2 = 1.0$

Values definition & printing

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$ b^2+c^2 $ % -- printing:  b^2 + c^2 value
$\pi $ % printing π value
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This is a TEX text ... in eq. (1) $\alpha := \pi/2$

$$b := \sin(\alpha) \qquad (1)$$

$$c := \cos(\alpha)$$

$\alpha/\pi = 0.5$
$b^2 + c^2 = 1.0$
$\pi = 3.14159265359$

Values definition & printing

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"\label{bdef}" % quotation - no calculation env.
\end{equation} %end of CalcTEX calculation env.
\[ c:=\cos(\alpha) \] % def.  of c value
$ \alpha/\pi $ % printing α/π value
$ b^2+c^2 $ % -- printing:  b^2 + c^2 value
$\pi $ % printing π value
"\[a^2+b^2=c^2\Leftrightarrow\]" % quotation
```

pdf Effect

This is a TEX text ... in eq. (1) $\alpha := \pi/2$

$$b := \sin(\alpha) \qquad (1)$$

$$c := \cos(\alpha)$$

$\alpha/\pi = 0.5$
$b^2 + c^2 = 1.0$
$\pi = 3.14159265359$
$a^2 + b^2 = c^2 \Leftrightarrow$

Values definition & printing

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$ \alpha/\pi $ % printing α/π value
$ b^2+c^2 $ % -- printing:  b^2 + c^2 value
$\pi $ % printing π value
"\[a^2+b^2=c^2\Leftrightarrow\]" % quotation
\[c:=\sqrt{a^2+b^2} \] % re-def.  of c value
```

pdf Effect

This is a TEX text ... in eq. (1) $\alpha := \pi/2$

$$b := \sin(\alpha) \qquad (1)$$

$$c := \cos(\alpha)$$

$\alpha/\pi = 0.5$

$b^2 + c^2 = 1.0$

$\pi = 3.14159265359$

$a^2 + b^2 = c^2 \Leftrightarrow$

$$c := \sqrt{a^2 + b^2}$$

Values definition & printing

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$ \alpha/\pi $ % printing α/π value
$ b^2+c^2 $ % -- printing:  b^2+c^2 value
$\pi $ % printing π value
"\[a^2+b^2=c^2\Leftrightarrow\]" % quotation
\[c:=\sqrt{a^2+b^2} \] % re-def.  of c value
$c$ %-- printing 'c' value
```

pdf Effect

This is a TEX text ... in eq. (1) $\alpha := \pi/2$

$$b := \sin(\alpha) \qquad (1)$$

$$c := \cos(\alpha)$$

$\alpha/\pi = 0.5$
$b^2 + c^2 = 1.0$
$\pi = 3.14159265359$
$a^2 + b^2 = c^2 \Leftrightarrow$

$$c := \sqrt{a^2 + b^2}$$

$c = 1.65165150928$

Values definition & printing

CalcTEX Sources – Example – 'ex01.tex'

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$\alpha := \pi/2 $
\begin{equation}
b:=\sin( \alpha)
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\[ c:=\cos(\alpha) \]
$ \alpha/\pi $
$ b^2+c^2 $
$\pi $
"\[a^2+b^2=c^2\Leftrightarrow\]"
\[c:=\sqrt{a^2+b^2} \]
$c$
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pdf Effect

This is a TEX text ... in eq. (1) $\alpha := \pi/2$

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$\alpha/\pi = 0.5$
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$a^2 + b^2 = c^2 \Leftrightarrow$

$$c := \sqrt{a^2 + b^2}$$

$c = 1.65165150928$

CalcTEX example for TEX sources

CalcTEX sources - 'tex-calc.tex'

```
Task \par
Tom has 81.52 kg ($m_t:=81.52$)
Ann has 59.9 kg ($m_a:=59.9"~)."$
How much is Tom's \& Ann's
weight? \par  Solution \par
We know: \par
$m_t$ kg, $m_a$ kg. \par
Tom's \& Ann's weight is:
$m_{ta}:=m_t+m_a","$
$m_{ta}$ kg.
\par Answer: \par
Tom's \& Ann's weihgt is
$m_{ta}"\rm~kg."$ \end
```

Effect - 'tex.tex'

Task
Tom has 81.52 kg ($m_t := 81.52$)
Ann has 59.9 kg ($m_a := 59.9$).
How much is Tom's & Ann's weight?
Solution
We know:
$m_t = 81.52$ kg, $m_a = 59.9$ kg.
Tom's & Ann's weight is:
$m_{ta} := m_t + m_a$, $m_{ta} = 141.42$ kg.
Answer:
Tom's & Ann's weihgt is
$m_{ta} = 141.42\ \mathrm{kg}$.

Units definition

For calculation with units is necessary a define of units for TEX and solver. (Basic units are equal 1.0)

Sources

```
\newcommand{\kg}{\rm kg}    $\kg:=1.0$
\newcommand{\gm}{\rm gm}
$\gm:=\kg/1000.0 $
\newcommand{\meter}{\rm m} $\m:=1.0$
\newcommand{\km}{\rm km}
$\km:=1000.0 \cdot \meter$
\newcommand{\s}{\rm s}      $\s:=1.0 $
\newcommand{\hr}{\rm hr}
$\hr:=3600.0 \cdot \s$
\newcommand{\J}{\rm J}      $\J:=1.0 $
```

Effect

$$\mathrm{kg} := 1.0$$
$$\mathrm{gm} := \mathrm{kg}/1000.0$$
$$\mathrm{m} := 1.0$$
$$\mathrm{km} := 1000.0 \cdot \mathrm{m}$$
$$\mathrm{s} := 1.0$$
$$\mathrm{hr} := 3600.0 \cdot \mathrm{s}$$
$$\mathrm{J} := 1.0$$

After that, if variables are defined in any above mentioned units: (`$v :=1202.4 \cdot\km/\hr$`) $v := 1202.4 \cdot \mathrm{km/hr}$ then this variables values are automatically converted into the basec units:

(`$ v $ m/s`) $v = 334.0$ m/s.

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For calculation with units is necessary a define of units for TEX and solver. (Basic units are equal 1.0)

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\newcommand{\kg}{\rm kg}    $\kg:=1.0$
\newcommand{\gm}{\rm gm}
$\gm:=\kg/1000.0 $
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Effect

$$\mathrm{kg} := 1.0$$
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$\mathrm{kg} := 1.0$

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$\hr:=3600.0 \cdot \s$
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Effect

$$\mathrm{kg} := 1.0$$
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After that, if variables are defined in any above mentioned units: (`$v :=1202.4 \cdot\km/\hr$`) $v := 1202.4 \cdot \mathrm{km/hr}$ then this variables values are automatically converted into the basec units:

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Effect

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After that, if variables are defined in any above mentioned units: (`$v :=1202.4 \cdot\km/\hr$`) $v := 1202.4 \cdot \mathrm{km/hr}$ then this variables values are automatically converted into the basec units:

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Calculation with units - example

Sources

```
\newcommand{\vv}{\vec{v}}
How much is the kinetic energy of an 251.5 gm
( $ m_b:=251.5\cdot \gm $ ) mass of ball
travelling at 1202.4 kilometers per hour
( $ \vv_b:=1202.4\cdot\km/\hr $ )?
\\ Calculation: \\ We know:\\
$ m_b $ {\rm kg}, $ \vv_b $ {\rm m/s}.\\
Kinetic energy is defined as:
\begin{equation}
E_k:=\frac{m_b\cdot \vv_b^2}{2}
\end{equation}
Units checking:
\begin{equation*}
\frac{m_b\cdot \vv_b^2}{2}=
\left[\rm \frac{kg\cdot(m/s)^2}{2}
=\frac{kg\cdot m^2}{s^2}=J \right]
\end{equation*}
Kinetic energy of this ball is $ E_k $ J.
```

Effect

How much is the kinetic energy of an 251.5 gm ($m_b := 251.5 \cdot \mathrm{gm}$) mass of ball travelling at 1202.4 kilometers per hour ($\vec{v}_b := 1202.4 \cdot \mathrm{km/hr}$)?
Calculation:
We know:
$m_b = 0.2515\ \mathrm{kg}$, $\vec{v}_b = 334.0\ \mathrm{m/s}$.
Kinetic energy is defined as:

$$E_k := \frac{m_b \cdot \vec{v}_b^2}{2} \tag{2}$$

Units checking:

$$\frac{m_b \cdot \vec{v}_b^2}{2} = \left[\frac{\mathrm{kg} \cdot (\mathrm{m/s})^2}{2} = \frac{\mathrm{kg} \cdot \mathrm{m}^2}{\mathrm{s}^2} = \mathrm{J}\right]$$

Kinetic energy of this ball is
$E_k = 14028.167\ \mathrm{J}$.

Compilation script - 'go-tex.sh' script

```
# 2008-08-15
# main script for simple CalcTeX calulation example

InputCalcTeXFile="tex-calc.tex"
OutPutCalcTeXFile="tex.tex"
TmpFile=$OutPutCalcTeXFile".tpy"
tTmpFile=$OutPutCalcTeXFile"t.tpy"


echo Converting $InputCalcTeXFile file into python file $TmpFile
sh ../bin/tex2py.sh  $InputCalcTeXFile $TmpFile

echo "Including math library in to python file - definition of 'e' & 'pi'"
echo "from math import * " > $tTmpFile
more $TmpFile >> $tTmpFile

echo using python for calculation
python < $tTmpFile > $OutPutCalcTeXFile
echo pdftex compilation
pdftex $OutPutCalcTeXFile
```

Python input & output file 4 'tex.tex' example part 1/2

tex.tpy – python input file

```
1 print "Task \\par"
2 print "Tom has 81.52 kg ( $"
3 print "m_t:=81.52"
4 m_t=81.52
5 print "$ )"
6 print "Ann has 59.9 kg ( $"
7 print "m_a:=59.9"
8 m_a=59.9
9 print "~).  "
10 print "$"
11 print "How much is Tom's \\& Ann's"
12 print "weight? \\par Solution \\par"
13 print "We know: \\par"
14 print "$"
15 print "m_t="
16 print m_t
17 print "$ kg, $"
18 print "m_a="
19 print m_a
```

tex.tex – python output file

```
1 Task \par
2 Tom has 81.52 kg ( $
3 m_t:=81.52
4 $ )
5 Ann has 59.9 kg ( $
6 m_a:=59.9
7 ~).
8 $
9 How much is Tom's \& Ann's
10 weight? \par Solution \par
11 We know: \par
12 $
13 m_t=
14 81.52
15 $ kg, $
16 m_a=
```

Python input & output file 4 'tex.tex' example part 2/2

tex.tpy – python input file

```
20 print "$ kg. \\par"
21 print "Tom's \\& Ann's weight is:"
22 print "$"
23 print "m_{ta}:=m_t+m_a"
24 m_ta=m_t+m_a
25 print ",  "
26 print "$"
27 print "$"
28 print "m_{ta}="
29 print m_ta
30 print "$ kg."
31 print "\\par Answer: \\par"
32 print "Tom's \\& Ann's weihgt is"
33 print "$"
34 print "m_{ta}="
35 print m_ta
36 print "\\rm~kg.  "
37 print "$ \\end"
```

tex.tex – python output file

```
19 Tom's \& Ann's weight is:
20 $
21 m_{ta}:=m_t+m_a
22 ,
23 $
24 $
25 m_{ta}=
26 141.42
27 $ kg.
28 \par Answer: \par
29 Tom's \& Ann's weihgt is
30 $
31 m_{ta}=
32 141.42
33 \rm~kg.
34 $ \end
```

The End

- many thanks 4 $\forall$ U attention!
- have a nice day!
- have nice CalcTEX calculations!
- 4 more info pls visit web page: http://sg.bzip.pl/CalcTeX/

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