The Ti\kZ-Extensions Package
Manual for version 0.2
https://github.com/Qrrbrbirlbel/tikz-extensions

Qrrbrbirlbel
August 21, 2022

Contents

I Introduction 4
1 Usage 4
2 Why do we need it? 4
3 Should these libraries be part of Ti\kZ? 4

II Ti\kZ Libraries 5
4 Calendar 6
  4.1 Value-keys and nestable if key ......................................................... 6
  4.2 Week numbering (ISO 8601) ............................................................... 6
5 Node Families 7
6 Arc to a point 9
<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>More Horizontal and Vertical Lines</td>
<td>11</td>
</tr>
<tr>
<td>7.1</td>
<td>Zig-Zag</td>
<td>11</td>
</tr>
<tr>
<td>7.2</td>
<td>Zig-Zig</td>
<td>13</td>
</tr>
<tr>
<td>7.3</td>
<td>Even more Horizontal and Vertical Lines</td>
<td>14</td>
</tr>
<tr>
<td>8</td>
<td>Extending the Path Timers</td>
<td>15</td>
</tr>
<tr>
<td>8.1</td>
<td>Rectangle</td>
<td>15</td>
</tr>
<tr>
<td>8.2</td>
<td>Parabola</td>
<td>15</td>
</tr>
<tr>
<td>8.3</td>
<td>Sine/Cosine</td>
<td>16</td>
</tr>
<tr>
<td>9</td>
<td>Using Images as a Pattern</td>
<td>17</td>
</tr>
<tr>
<td>10</td>
<td>Positioning Plus</td>
<td>18</td>
</tr>
<tr>
<td>10.1</td>
<td>Useful corner anchors</td>
<td>18</td>
</tr>
<tr>
<td>10.2</td>
<td>Useful placement keys for vertical and horizontal alignment</td>
<td>19</td>
</tr>
<tr>
<td>11</td>
<td>Arcs through Three Points</td>
<td>23</td>
</tr>
<tr>
<td>12</td>
<td>Mirror, Mirror on the Wall</td>
<td>24</td>
</tr>
<tr>
<td>12.1</td>
<td>Using the reflection matrix</td>
<td>24</td>
</tr>
<tr>
<td>12.2</td>
<td>Using built-in transformations</td>
<td>25</td>
</tr>
<tr>
<td>III</td>
<td>PGF Libraries</td>
<td>27</td>
</tr>
<tr>
<td>13</td>
<td>Transformations: Mirroring</td>
<td>28</td>
</tr>
<tr>
<td>13.1</td>
<td>Using the reflection matrix</td>
<td>28</td>
</tr>
<tr>
<td>13.2</td>
<td>Using built-in transformations</td>
<td>28</td>
</tr>
<tr>
<td>IV</td>
<td>Utilities</td>
<td>30</td>
</tr>
<tr>
<td>14</td>
<td>Calendar: Weeknumbers and more conditionals</td>
<td>31</td>
</tr>
<tr>
<td>14.1</td>
<td>Extensions</td>
<td>31</td>
</tr>
<tr>
<td>14.2</td>
<td>Week numbering (ISO 8601)</td>
<td>31</td>
</tr>
<tr>
<td>15</td>
<td>And a little bit more</td>
<td>32</td>
</tr>
<tr>
<td>15.1</td>
<td>PGFmath</td>
<td>32</td>
</tr>
<tr>
<td>15.1.1</td>
<td>Postfix operator R</td>
<td>32</td>
</tr>
</tbody>
</table>
Part I

Introduction

1 Usage

This package is called `tikz-ext`, however, one can’t load it via \usepackage. Instead, this package consists of multiple PGF and TikZ libraries which are loaded by either \usepgflibrary or \usetikzlibrary.

2 Why do we need it?

Since I have been answering questions on TeX.sx I’ve noticed that some questions come up again and again, every time with a slightly different approach on how to solve them.

I don’t like reinventing the wheel which is why I’ve gathered the code of my answers in this package.

And, yes, I am using them myself, too.

3 Should these libraries be part of TikZ?

I guess.
Part II
TikZ Libraries

These libraries only work with TikZ.
4 Calendar

TikZ Library `ext.calendar-plus`

\usetikzlibrary{ext.calendar-plus} % \LaTeX{} and plain \TeX{}
\usetikzlibrary{ext.calendar-plus} % \ConTeXt{}

This library extends the TikZ library calendar.

### 4.1 Value-keys and nestable if key

The values of following keys are originally stored in some macros that are not accessible by the user. These are now simple value-keys. The \@-protected macros are still available, of course.

- `/tikz/day xshift` (initially 3ex)
- `/tikz/day yshift` (initially 3.5ex)
- `/tikz/month xshift` (initially 9ex)
- `/tikz/month yshift` (initially 9ex)

It is now also possible to nest `/tikz/if` occurrences.

- `/tikz/if=(⟨conditions⟩)(⟨code or options⟩)else(⟨else code or options⟩)` (no default)

### 4.2 Week numbering (ISO 8601)

The actual week number algorithm is implemented by the pgfcalendar-ext package/module in section 14.2.

- `/tikz/week code=⟨code⟩` (no default)
  
  Works like `/tikz/day code` or `/tikz/month code`, only for weeks.

- `/tikz/week text=(⟨text⟩)` (no default)
  
  Works like `/tikz/day text` or `/tikz/month text`, only for weeks.

- `/tikz/every week` (style, no value)
  
  Works like `/tikz/every day` or `/tikz/every month`, only for weeks.

- `/tikz/week label left` (style, no value)
  
  Places the week label to the left of the first day of the month. (For `week list` and `month list` where a week does not start on a Monday, the position is chosen “as if” the week had started on a Monday – which is usually exactly what you want.)

```latex
\usetikzlibrary{ext.calendar-plus}
\tikz
\calendar [week list, month label above centerered, dates=2022-07-01 to 2022-07-31, week label left, every week/.append style={gray!50!black,font=\sffamily}];
```

<table>
<thead>
<tr>
<th></th>
<th>July</th>
</tr>
</thead>
<tbody>
<tr>
<td>26</td>
<td>1 2 3</td>
</tr>
<tr>
<td>27</td>
<td>4 5 6 7 8 9 10</td>
</tr>
<tr>
<td>28</td>
<td>11 12 13 14 15 16 17</td>
</tr>
<tr>
<td>29</td>
<td>18 19 20 21 22 23 24</td>
</tr>
<tr>
<td>30</td>
<td>25 26 27 28 29 30 31</td>
</tr>
</tbody>
</table>
5 Node Families

\textbf{TikZ Library \texttt{ext.node-families}}

\begin{verbatim}
\usetikzlibrary{ext.node-families} % \LaTeX{} and plain \TeX{}
\usetikzlibrary{ext.node-families} % Con\TeX
\end{verbatim}

With this library the user can instruct multiple nodes to have the same width, height, text width, text height or text width. This uses the hook /tikz/execute at end picture to write the nodes’ measurements to the AUX file.

Unfortunately, this does not work with the external library.\footnote{Not only would the external library not notice the change of the value between compilations runs, it also changes the way \texttt{\pgfutil@writeout} works which suddenly writes to the log file instead.}

This library introduces two new shapes called \texttt{Circle} and \texttt{Rectangle} that are basically copies of the original shapes \texttt{circle} and \texttt{rectangle}. However, their dimension will be set to the same maximum minimum width and minimum height when one of the following \texttt{name}\texttt{s} are declared.

\begin{verbatim}
/tikz/node family/width=(name) \hspace{3.5em} (no default, initially {})\end{verbatim}

Nodes with the same \texttt{name} will have the same \texttt{/pgf/minimum width}. An empty \texttt{name} disables the evaluation by the library.

\begin{verbatim}
/tikz/node family/height=(name) \hspace{3.5em} (no default, initially {})
\end{verbatim}

Nodes with the same \texttt{name} will have the same \texttt{/pgf/minimum height}. An empty \texttt{name} disables the evaluation by the library.

\begin{verbatim}
/tikz/node family/size=(name) \hspace{3.5em} (no default)
\end{verbatim}

Sets both height and width.

While \texttt{node family/width} and \texttt{node family/height} only work for the new shapes \texttt{Circle} and \texttt{Rectangle}, the following keys – when setup, see below – work with every shape with one single node part. Initially though, only \texttt{circle}, \texttt{rectangle}, \texttt{Circle} and \texttt{Rectangle} are set up that way.

\begin{verbatim}
/tikz/node family/text height=(name) \hspace{3.5em} (no default, initially {})
\end{verbatim}

Nodes with the same \texttt{name} will have the same text height. An empty \texttt{name} disables the evaluation by the library.

\begin{verbatim}
/tikz/node family/text depth=(name) \hspace{3.5em} (no default, initially {})
\end{verbatim}

Nodes with the same \texttt{name} will have the same text depth. An empty \texttt{name} disables the evaluation by the library.
/tikz/node family/text width=(name)
Nodes with the same (name) will have the same text width. An empty (name) disables the evaluation by the library.

/tikz/node family/text=(name)
Sets text height, text depth and text width.

Since the width of the node’s content’s box is setup much earlier, the previous key only extends the width of that box which would make the text seem as if it were aligned to the left. With text width family align this can changed.

/tikz/node family/text width align=(alignment)
(.alignment) is one of left, center or right.

/Foo
/Foobar

\usetikzlibrary {positioning,ext.node-families}
\tikzexternaldisable % ext.node-families does not work with active externalization
\begin{tikzpicture}[nodes={Rectangle, draw, node family={text width=manual, text width align=right}}]
\node (a) {Foo};
\node[below=of a] (b) {Foobar};
\end{tikzpicture}

/tikz/node family/prefix=(prefix)
The family names are prefixed with the value of /tikz/node family/prefix.

/tikz/node family/setup shape=(shape)
This adds instructions to the (shape)’s definition which adjust the text box’s dimensions according to the family.
This should be only used once per shape.

/a
/b
/c
/d
/e
/f
/g
/h

\usetikzlibrary {ext.node-families,shapes.geometric}
\tikzexternaldisable % ext.node-families does not work with active externalization
\begin{tikzpicture}[node family/setup shape=diamond]
\foreach \cnt[count=\Cnt] in {a,...,h}
\node[draw, diamond, node family/text=aTOh] (\cnt)
at (right:\Cnt) \cnt;
\draw[help lines] (a.south) -- (h.south) (a.north) -- (h.north) (a.base-|a.west) -- (h.base-|h.east);
\end{tikzpicture}
6 Arc to a point

TikZ Library \texttt{ext.paths.arcto}

\begin{tikzpicture}
\coordinate [dot=below left:$a$] (a) at (0,0);
\coordinate [dot=above right:$b$] (b) at (2,3);
\begin{scope}
\radius=3,\nodes={shape=circle,fill=white,fill opacity=.9,text opacity=1,inner sep=+0pt,sloped,allow upside down}
\draw [blue] (a) arc to [clockwise] node [near start] {.25} node {.5} node [near end] {.75} (b);
\draw [red] (a) arc to [large] node [near start] {.25} node {.5} node [near end] {.75} (b);
\draw [blue!50] (a) arc to [large, clockwise] node [near start] {.25} node [.5] node [near end] {.75} (b);
\draw [red!50] (a) arc to [large, clockwise] node [near start] {.25} node [.5] node [near end] {.75} (b);
\end{scope}
\fill [radius=2pt] (a) circle[] (b) circle[];
\end{tikzpicture}

\begin{verbatim}
\usetikzlibrary{ext.paths.arcto}
\begin{tikzpicture}[ultra thick,dot/.style={label=\textcolor{black}{#1}}]
\coordinate [dot=below left:$a$] (a) at (0,0);
\coordinate [dot=above right:$b$] (b) at (2,3);
\begin{scope}[\radius=3,\nodes={shape=circle,fill=white,fill opacity=.9,text opacity=1,inner sep=+0pt,sloped,allow upside down}]
\draw [blue] (a) arc to [clockwise] node [near start] {.25} node {.5} node [near end] {.75} (b);
\draw [red] (a) arc to [large] node [near start] {.25} node {.5} node [near end] {.75} (b);
\draw [blue!50] (a) arc to [large, clockwise] node [near start] {.25} node [.5] node [near end] {.75} (b);
\draw [red!50] (a) arc to [large, clockwise] node [near start] {.25} node [.5] node [near end] {.75} (b);
\end{scope}
\fill [radius=2pt] (a) circle[] (b) circle[];
\end{tikzpicture}
\end{verbatim}

\begin{verbatim}
\usetikzlibrary{ext.paths.arcto}
\begin{tikzpicture}[ultra thick,dot/.style={label=\textcolor{black}{#1}}]
\coordinate [dot=below left:$a$] (a) at (0,0);
\coordinate [dot=above right:$b$] (b) at (2,3);
\begin{scope}[\radius=3,\nodes={shape=circle,fill=white,fill opacity=.9,text opacity=1,inner sep=+0pt,sloped,allow upside down}]
\draw [blue] (a) arc to [clockwise] node [near start] {.25} node {.5} node [near end] {.75} (b);
\draw [red] (a) arc to [large] node [near start] {.25} node {.5} node [near end] {.75} (b);
\draw [blue!50] (a) arc to [large, clockwise] node [near start] {.25} node [.5] node [near end] {.75} (b);
\draw [red!50] (a) arc to [large, clockwise] node [near start] {.25} node [.5] node [near end] {.75} (b);
\end{scope}
\fill [radius=2pt] (a) circle[] (b) circle[];
\end{tikzpicture}
\end{verbatim}

\path ... \texttt{arc to(\texttt{options})}(\texttt{coordinate or cycle}) ...;

When this operation is used, the path gets extended by an arc that goes through the current point and (coordinate).

For two points there exist two circles or four arcs that go through or connect these two points. Which one of these is constructed is determined by the following options that can be used inside of (options).

/tikz/arc to/clockwise

(style, no value)
This constructs an arc that goes clockwise.

/tikz/arc to/counter clockwise
This constructs an arc that goes counter clockwise.
This is the default.

/tikz/arc to/large
This constructs an arc whose angle is larger than $180^\circ$.

/tikz/arc to/small
This constructs an arc whose angle is smaller than $180^\circ$.

/tikz/arc to/rotate=$(degree)$
Rotates the arc by $(degree)$. This is only noticeable when $x$ radius and $y$ radius are different.

/tikz/arc to/x radius=$(value)$
This forwards the $(value)$ to /tikz/x radius. Its $(value)$ is used for the radius of the arc.

/tikz/arc to/y radius=$(value)$
This forwards the $(value)$ to /tikz/y radius. Its $(value)$ is used for the radius of the arc.

/tikz/arc to/radius=$(value)$
This forwards the $(value)$ to both /tikz/x radius and /tikz/y radius. Its $(value)$ is used for radius of the arc.

/tikz/every arc to
After /tikz/every arc this will also be applied before any $(options)$ are set.

It should be noted that this uses \pgfpatharcto for which the TikZ manual warns:

The internal computations necessary for this command are numerically very unstable. In particular, the arc will not always really end at the $(target coordinate)$, but may be off by up to several points. A more precise positioning is currently infeasible due to \TeX’s numerical weaknesses. The only case it works quite nicely is when the resulting angle is a multiple of $90^\circ$.

The arc to path operation will also work only in the canvas coordinate system. The lengths of the vectors $(1, 0)$ and $(0, 1)$ will be used for the calculation of the radii but no further consideration is done.
7 More Horizontal and Vertical Lines

TikZ Library `ext.paths.ortho`

\usetikzlibrary{ext.paths.ortho} % \LaTeX{} and plain \TeX{}
\usetikzlibrary{ext.paths.ortho} % Con\TeX{}

This library adds new path specifications \texttt{|-|}, \texttt{-|} as well as \texttt{r-ud}, \texttt{r-du}, \texttt{r-lr} and \texttt{r-rl}.

7.1 Zig-Zag

Similar to the path operations \texttt{|-|} and \texttt{-|} this library adds the path operations \texttt{|-|} and \texttt{-|}.

\begin{verbatim}
\path ... |-|\{(options)\}\{coordinate or cycle\} ...;
\end{verbatim}

This operation means “first vertical, then horizontal and then vertical again”.

\begin{verbatim}
\path ... -|-\{(options)\}\{coordinate or cycle\} ...;
\end{verbatim}

This operation means “first horizontal, then vertical and then horizontal again”.

\texttt{/tikz/hvvh/ratio=(ratio)}

(no default, initially 0.5)

This sets the ratio for the middle part of the Zig-Zag connection.

For values \texttt{(ratio) < 0} and \texttt{(ratio) > 1} the Zig-Zag lines will look more like Zig-Zig lines.

\begin{verbatim}
\usetikzlibrary{paths.ortho}
\begin{tikzpicture}[very thick, rounded corners]
\draw[help lines] (-.25, -1.25) grid (2.25, 1.25);
\draw (0, 0) -|- (2, 1) -- (2, 0) -|- [ratio=.25] (0,-1) -- cycle;
\end{tikzpicture}
\end{verbatim}

\texttt{/tikz/hvvh/distance=(distance)}

(no default)

This sets the distance between the start point and the middle part of the Zig-Zag connection.

For values \texttt{(distance) < 0} the distance will be used for the target coordinate.
When nodes get connected the placement of the middle part of the Zig-Zag and the Zig-Zig (see below) connections will be calculated from the border of these nodes. The middle part of the connections can be calculated from the nodes’ center if this key is set to `true`.

New timers are setup for both the Zig-Zag and the Zig-Zig connections, these can be configured through the following keys.

/\texttt{tikz/hvvh/from center}=(true or false)  
(default true)

Unless ⟨\texttt{number}⟩ = 0 is set

- `pos = 0` will be at the start,
- `pos = 1` will be at the end,
- `pos = \frac{1}{⟨\texttt{number}⟩}` will be at the first kink,
- `pos = \frac{⟨\texttt{number}⟩-1}{⟨\texttt{number}⟩}` will be at the second kink and
- `pos = .5` will be in the middle of the middle part of the connection.
If $\langle \text{number} \rangle = 0$ then

- $\text{pos} = -1$ will be at the start,
- $\text{pos} = 2$ will be at the end,
- $\text{pos} = 0$ will be at the first kink,
- $\text{pos} = 1$ will be at the second kink and
- $\text{pos} = .5$ will still be in the middle of the middle part of the connection.

If $\langle \text{number} \rangle = 0$ then

- $\text{pos} = -1$ will be at the start,
- $\text{pos} = 2$ will be at the end,
- $\text{pos} = 0$ will be at the first kink,
- $\text{pos} = 1$ will be at the second kink and
- $\text{pos} = .5$ will still be in the middle of the middle part of the connection.

\tikz/hvvh/middle 0 to 1

This is an alias for \texttt{spacing} = 0.

### 7.2 Zig-Zig

\tikz/udlr/ud distance=\langle \text{length} \rangle

This sets the distance between the start and the horizontal line to $\langle \text{length} \rangle$.

\path \ldots \texttt{r-ud}[\langle \text{options} \rangle](\text{coordinate or cycle}) \ldots;

This operation means "first up, then horizontal and then down".

\tikz/udlr/du distance=\langle \text{length} \rangle

This sets the distance between the start and the horizontal line to $\langle \text{length} \rangle$.

\path \ldots \texttt{r-du}[\langle \text{options} \rangle](\text{coordinate or cycle}) \ldots;

This operation means "first down, then horizontal and then up".

\tikz/udlr/lr distance=\langle \text{length} \rangle

This sets the distance between the start and the vertical line to $\langle \text{length} \rangle$.

\path \ldots \texttt{r-lr}[\langle \text{options} \rangle](\text{coordinate or cycle}) \ldots;

This operation means "left down, then vertical and then right".

\tikz/udlr/rl distance=\langle \text{length} \rangle

This sets the distance between the start and the vertical line to $\langle \text{length} \rangle$.

\path \ldots \texttt{r-rl}[\langle \text{options} \rangle](\text{coordinate or cycle}) \ldots;

This operation means "first right, then vertical and then down".

All distances can be set with \texttt{on key}. 
/tikz/udlr/distance=(length)  
Sets all distances in the /tikz/udlr namespace.  

/tikz/udlr/from center=(true or false)  
This is an alias for /tikz/hvvh/from center.  

(7.3) Even more Horizontal and Vertical Lines

The following keys can be used to access vertical and horizontal line path operations.

/tikz/horizontal vertical
This installs to path = -| (\tikztotarget) \tikztonodes that can be used with the path operations to or edge.

/tikz/vertical horizontal
This installs to path = |- (\tikztotarget) \tikztonodes that can be used with the path operations to or edge.

/tikz/horizontal vertical horizontal
This installs to path = -|- (\tikztotarget) \tikztonodes that can be used with the path operations to or edge.

/tikz/vertical horizontal vertical
This installs to path = |-| (\tikztotarget) \tikztonodes that can be used with the path operations to or edge.

When connecting rectangular nodes, these keys could be useful as well. They all need to be given to a to or edge path operation.

/tikz/only vertical second=(length)
This draws a vertical line from the start point to the target point so that it connects to the target point in the center (or at its border in case it is a node).  
The optional (length) can be used to shift the line orthogonally to its direction.

/tikz/only horizontal second=(length)
This draws a horizontal line from the start point to the target point so that it connects to the target point in the center (or at its border in case it is a node).  
The optional (length) can be used to shift the line orthogonally to its direction.

/tikz/only vertical first=(length)
This draws a vertical line from the start point to the target point so that it connects to the start point in the center (or at its border in case it is a node).  
The optional (length) can be used to shift the line orthogonally to its direction.

/tikz/only horizontal first=(length)
This draws a horizontal line from the start point to the target point so that it connects to the start point in the center (or at its border in case it is a node).  
The optional (length) can be used to shift the line orthogonally to its direction.
8 Extending the Path Timers

TikZ Library \texttt{ext.paths.timer}

\begin{tikzpicture}[scale=2, every pin edge/.style={latex-, gray}]
\coordinate [label=above right:Target] (A) at (0,0);
\coordinate [label=below left:Start] (B) at (1,2);
\draw[->, help lines] (\[shift=(50:.3 and .75)\] .5,1) arc[start angle=50, delta angle=340, x radius=.3, y radius=.75];
\draw (B) rectangle (A)
\foreach \pos/\ang in {at start/60, very near start/90, near start/180, pos=.375/180, midway/180, pos=.625/270, near end/0, very near end/0, at end/0}{
  node[pin=\ang:\pos, style/.expanded=\pos{}];}
\end{tikzpicture}

This library adds timers to the path specifications \texttt{rectangle}, \texttt{parabola}, \texttt{sin} and \texttt{cos}.

In \texttt{TikZ}, the path specification \texttt{rectangle}, \texttt{parabola}, \texttt{sin} and \texttt{cos} do not provide their own timer, i.e. a node placing algorithm that is dependent on the actual path. For \texttt{rectangle} the timer of the straight line between the rectangle’s corners is used, for the other paths, nodes, coordinates, pics, etc. are placed on the last coordinate.

This library allows this.

8.1 Rectangle

For the \texttt{rectangle} path operator, the timer starts with $\text{pos} = 0 \ (= \text{at start})$ from the starting coordinate in a counter-clockwise direction along the rectangle. The corners will be at positions 0.0, 0.25, 0.5, 0.75 and 1.0.

8.2 Parabola

For the \texttt{parabola} path operator the timer is similar to the \texttt{.. controls ..} operator.

The position 0.5 will lie at the bend.
If no bend is specified half the positions will collapse into one end of the curve.

8.3 Sine/Cosine

The \texttt{sin} and \texttt{cos} path operators also allow placing of nodes along their paths.
9 Using Images as a Pattern

TikZ Library `ext.patterns.images`

This library allows to use an image to be used as a repeating pattern for a path.

With this library arbitrary images (or indeed PDF documents) can be used as a repeating pattern for the background of a path.

This is a two-step process:

1. Declaring an image as an “image-pattern”.
2. Using the “image-pattern”.

\texttt{\pgfsetupimageaspattern\{(options)\}\{\(name\)\}\{\(image\)\}}

\texttt{/tikz/image as pattern=(options)}

\texttt{\pgfsetupimageaspattern\{width=.5cm\}\{grid\}\{example-image-1x1\}\
\tikz \node[star, minimum size=3cm, draw,\
image as pattern={name=grid, options=\{left, bottom, y=-.5cm, rotate=45\}}] {}};

\texttt{/tikz/image as pattern/name=(name)}

Specifies the name of the “image-pattern” to be used.

\texttt{/tikz/image as pattern(option)}

Options that’s be used by the internal \texttt{\pgf/text}, only keys from \texttt{\pgf/text} should be used.

\texttt{/tikz/image as pattern/options=(style)}

Appends style \texttt{/tikz/image as pattern\/option}.
10 Positioning Plus

TikZ Library `ext.positioning-plus`

\usetikzlibrary{ext.positioning-plus} % \LaTeX{} and plain \TeX{}
\usetikzlibrary{ext.positioning-plus} % Con\TeX{}

With the help of the positioning and the fit library this extends the placement of nodes.

10.1 Useful corner anchors

The anchors `corner north east`, `corner north west`, `corner south west` and `corner south east` are defined as "generic anchors", i.e. they are defined for all shapes. This is mostly useful for the placement of circular shapes.

`/tikz/corner above left=(specification)`

Similar as `/tikz/above left` of the TikZ library positioning but uses the `corner north west` anchor.

`/tikz/corner below left=(specification)`

Similar as `/tikz/below left` of the TikZ library positioning but uses the `corner south west` anchor.

`/tikz/corner above right=(specification)`

Similar as `/tikz/above right` of the TikZ library positioning but uses the `corner north east` anchor.

`/tikz/corner below right=(specification)`

Similar as `/tikz/below right` of the TikZ library positioning but uses the `corner south east` anchor.
10.2 Useful placement keys for vertical and horizontal alignment

/\tikz/north left=⟨specification⟩ (style, default 0pt)

Like /\tikz/left but aligns the nodes at their north border.

This is basically the same as left=of reference.north west, anchor=north east.
/tikz/north right=(specification)  
Like/tikz/right but aligns the nodes at their north border.
This is basically the same as left=of reference.north east, anchor=north west.

/tikz/south left=(specification)  
Like/tikz/left but aligns the nodes at their south border.
This is basically the same as left=of reference.south west, anchor=south east.

/tikz/south right=(specification)  
Like/tikz/right but aligns the nodes at their south border.
This is basically the same as left=of reference.south east, anchor=south west.

/tikz/west above=(specification)  
Like/tikz/above but aligns the nodes at their west border.
This is basically the same as left=of reference.north west, anchor=south west.

/tikz/west below=(specification)  
Like/tikz/below but aligns the nodes at their west border.
This is basically the same as left=of reference.south west, anchor=north west.

/tikz/east above=(specification)  
Like/tikz/above but aligns the nodes at their east border.
This is basically the same as left=of reference.north east, anchor=south east.

/tikz/east below=(specification)  
Like/tikz/below but aligns the nodes at their east border.
This is basically the same as left=of reference.south east, anchor=north east.
The same exist for the recently introduces corner anchors, too.

\tikz/corner north left = \langle specification \rangle

The same as \tikz/north left but uses the new corner anchors.

\tikz/corner north right = \langle specification \rangle

The same as \tikz/north right but uses the new corner anchors.

\tikz/corner south left = \langle specification \rangle

The same as \tikz/south left but uses the new corner anchors.

\tikz/corner south right = \langle specification \rangle

The same as \tikz/south right but uses the new corner anchors.

\tikz/corner west above = \langle specification \rangle

The same as \tikz/west above but uses the new corner anchors.

\tikz/corner west below = \langle specification \rangle

The same as \tikz/west below but uses the new corner anchors.

\tikz/corner east above = \langle specification \rangle

The same as \tikz/east above but uses the new corner anchors.

\tikz/corner east below = \langle specification \rangle

The same as \tikz/east below but uses the new corner anchors.

While the \langle specification \rangle of all these keys still accept the same form as with Ti\k, the ext.positioning-plus library extends this even more.

The specification after of can contain a list of coordinates (like the fit key of the fit library). This means that the new node will be placed in relation to a rectangular bounding box that fits around all this nodes in the list.

If this list is prefixed with |, - or +, the new node will also have the same height (|), the same width (-) or both as this bounding box.

\usetikzlibrary{ext.positioning-plus}
\begin{tikzpicture}[nodes=draw]
\node (A) at (0,0) {A};
\node[below=of A] (BCD) {BCD};
\node[right=of \langle A/BOD \rangle] (c) {c};
\node[below=5 of \langle A/BOD \rangle] (d) {d};
\draw[help lines] (BCD.south west) -- (c.south east) (BCD.north east) -- (d.south east);
\end{tikzpicture}

This functionality is also available without the placement:
/tikz/fit bounding box={list of coordinates} (style, no default)

Creates a rectangular node with the name fit bounding box that encompasses the (list of coordinates).

/tikz/span vertical={list of coordinates} (style, no default)

Creates a rectangular node with the name fit bounding box that encompasses the (list of coordinates) and sets the /pgfminimum height to the height of this bounding box.

/tikz/span horizontal={list of coordinates} (style, no default)

Creates a rectangular node with the name fit bounding box that encompasses the (list of coordinates) and sets the /pgfminimum width to the width of this bounding box.

/tikz/span={list of coordinates} (style, no default)

Is a combination of /tikz/span vertical and /tikz/span horizontal.

As you may notice in the example above, the (specification) also allows a prefix delimited by : which the node distance will be multiplied with for the placement.\(^2\)

\(^2\)This is probably more useful when /tikz/on grid is used.
11 Arcs through Three Points

TikZ Library `ext.topaths.arcthrough`

\usetikzlibrary{ext.topaths.arcthrough} % \LaTeX{} and plain \TeX{}
\usetikzlibrary{ext.topaths.arcthrough} % Con\TeX{}

This library allows to use an arc defined by three points.

\begin{tikzpicture}
\coordinate [label=above right:$A$] (A) at (3,1);
\coordinate [label=above:$B$] (B) at (1,2);
\coordinate [label=below left:$C$] (C) at (-2,-2);
\draw [ultra thick, draw=green, fill=green!50] (B) to [arc through={clockwise,(A)}] (C)
-- (arc through center) -- cycle;
\draw [ultra thick, draw=blue, fill=blue!50] (B) to [arc through={A}] (C)
-- (arc through center) -- cycle;
\foreach \p in {A,B,C, arc through center} \fill [red] (\p) circle [radius=2pt];
\end{tikzpicture}

This can only be used for circles in the canvas coordinate system.

\texttt{/tikz/arc through/through=(coordinate)} (no default, initially \((0,0)\))

The coordinate on the circle that defines – together with the starting and target point – a circle.

\texttt{/tikz/arc through/center suffix=(suffix)} (no default, initially )

The \texttt{arc through} will define a coordinate named \texttt{arc through center(suffix)} so that it can be referenced later.

\texttt{/tikz/arc through/clockwise} (no value)

The resulting arc will go clockwise from the starting point to the target point.

This will not necessarily go through the through point.

\texttt{/tikz/arc through/counter clockwise} (no value)

The resulting arc will go counter clockwise from the starting point to the target point. This will not necessarily go through the through point.

\texttt{/tikz/arc through=(key-value)} (no default)

This key should be used with to or edge. A parameter other than center suffix, clockwise or counter clockwise will be assumed to be the through coordinate.
12 Mirror, Mirror on the Wall

TikZ Library \texttt{ext.transformations.mirror}

\begin{verbatim}
\usetikzlibrary{ext.transformations.mirror} \% \LaTeX{} and plain \TeX{}
\usetikzlibrary{ext.transformations.mirror} \% Con\TeX t

This library adds more transformations to TikZ.

As explained in section 13, there are two approaches to setting a mirror transformation. As with the commands in PGF, we’ll be using a lowercase \texttt{m} for the reflection matrix and an uppercase \texttt{M} for the built-in approach.

12.1 Using the reflection matrix

\begin{verbatim}
\usetikzlibrary{shapes.geometric,ext.transformations.mirror}
\begin{tikzpicture}[line join=round, thick, reg poly/.style={
  shape=regular polygon, regular polygon sides=#1}]
\node[reg poly=5, minimum size=+2cm, draw, very thick] (a) {};
\foreach \i[evaluate={\col=(\i-1)/.04}] in {1,...,5}
\node[mirror=(a.corner \i)--(a.side \i), transform shape, reg poly=5, minimum size=+2cm, draw=red!\col!blue] {};
\end{tikzpicture}
\end{verbatim}

\texttt{/tikz/xmirror=⟨value or coordinate⟩} \hspace{1em} (no default)

Sets up a transformation that mirrors along a horizontal line that goes through point \((⟨value⟩,0)\) or \((⟨coordinate⟩)\).
/tikz/ymirror=\langle\text{value or coordinate}\rangle

Sets up a transformation that mirrors along a vertical line that goes through point (0, \langle\text{value}\rangle) or \langle\text{coordinate}\rangle.

/tikz/mirror x=\langle\text{coordinate}\rangle

Similar to /tikz/xmirror, this however uses the \texttt{xyz} coordinate system instead of the \texttt{canvas} system.

\usetikzlibrary{ext.transformations.mirror}
\begin{tikzpicture}[x=.5cm, y=(45:1cm)]
\draw[-latex] (0,0) .. controls (.5,1) .. (1,1);
\draw[dashed] (1.5, -.25) coordinate (m) -- (1.5, 1.25);
\draw[xmirror=(m), -latex, red, dotted] (0,0) .. controls (.5,1) .. (1,1);
\draw[mirror x=(m), -latex] (0,0) .. controls (.5,1) .. (1,1);
\end{tikzpicture}

/tikz/mirror y=\langle\text{coordinate}\rangle

Similar to /tikz/ymirror, this however uses the \texttt{xyz} coordinate system instead of the \texttt{canvas} system.

/tikz/mirror=\langle\text{point A}\rangle--\langle\text{point B}\rangle

Sets up a transformation that mirrors along a line that goes through \langle\text{point A}\rangle and \langle\text{point B}\rangle.

When only \langle\text{point A}\rangle is given that line goes through \langle\text{point A}\rangle and the origin.

12.2 Using built-in transformations

\usetikzlibrary{shapes.geometric,ext.transformations.mirror}
\begin{tikzpicture}[line join=round, thick, reg poly/.style={
    shape=regular polygon, regular polygon sides=#1}]
\node[reg poly=5, minimum size=2cm, draw, very thick] (a) {};
\foreach \i [evaluate={\col=(\i-1)/.04}] in {1,...,5}
\node [Mirror=(a.corner \i)--(a.side \i), transform shape, reg poly=5, minimum size=2cm, draw=red!\col!blue] {};
\end{tikzpicture}
---

/tikz/xMirror={value or coordinate}

Sets up a transformation that mirrors along a horizontal line that goes through point \((langle value\rangle, 0)\) or \(langle coordinate\rangle\).

```
\usetikzlibrary{ext.transformations.mirror}
\begin{tikzpicture}
\draw[help lines] (-0.25, -.25) grid (3.25, 1.25);
\draw[-latex] (0,0) .. controls (.5,1) .. (1,1);
\draw[dashed] (1.5, -.25) coordinate (m) -- (1.5, 1.25);
\draw[xMirror=(m),-latex, red, dotted] (0,0) .. controls (.5,1) .. (1,1);
\end{tikzpicture}
```

---

/tikz/yMirror={value or coordinate}

Sets up a transformation that mirrors along a vertical line that goes through point \((0, langle value\rangle)\) or \(langle coordinate\rangle\).

---

/tikz/Mirror x={coordinate}

Similar to /tikz/xMirror, this however uses the \texttt{xyz} coordinate system instead of the \texttt{canvas} system.

```
\usetikzlibrary{ext.transformations.mirror}
\begin{tikzpicture}[x=.5cm, y=(45:1cm)]
\draw[-latex] (0,0) .. controls (.5,1) .. (1,1);
\draw[dashed] (1.5, -.25) coordinate (m) -- (1.5, 1.25);
\draw[xMirror=(m),-latex, red, dotted] (0,0) .. controls (.5,1) .. (1,1);
\end{tikzpicture}
```

---

/tikz/Mirror y={coordinate}

Similar to /tikz/yMirror, this however uses the \texttt{xyz} coordinate system instead of the \texttt{canvas} system.

---

/tikz/Mirror={point A}--{point B}

Sets up a transformation that mirrors along a line that goes through \(langle point A\rangle\) and \(langle point B\rangle\).

When only \(langle point A\rangle\) is given that line goes through \(langle point A\rangle\) and the origin.

---

26
Part III
PGF Libraries

These libraries (should) work with both PGF and TikZ.

\usetikzlibrary{graphs,graphdrawing,ext.misc}\usetikzlibrary{force}
tikzset{
mynode/.style={
circle, minimum size=10mm, draw, densely dashdotted, thick,
decide color/.expand once=#1,
decide color/.style 2 args={
/utils/TeX/if=#1
{\utils/TeX/ifnum={#2<5}{bluelight}{bluedark}}
{\utils/TeX/ifnum={#2<8}{light}{dark}}},
light/.style={fill=gray!20}, bluelight/.style={fill=blue!10},
dark/.style={fill=gray!60}, bluedark/.style={fill=blue!30}
}
tikz\graph[
spring electrical layout, vertical=c2 to p13, 
node distance=1.5cm, typeset={$n_{\text{\tikzgraphnodetext}}$},
nodes={mynode=\tikzgraphnodetext}\]
{% outer ring
  c2 -- {p1, p11, p6};
  p1 -- {p8, c6, p11};
  p8 -- {p3, p10, c6};
  p3 -- {p13, p15, p10};
  p13 -- {p15, c7};
  c7 -- {c3, c4, p15};
  c3 -- {p14, c4};
  p14 -- {p7, c4};
  p7 -- {p9, p2, c4};
  p9 -- {c5, p12, p2};
  c5 -- {c1, p4, p12};
  c1 -- {p6, p4};
  p6 -- {p11, p4};
}% inner ring
  p11 -- {c6, p12, p4};
  p5 -- {c6 -- {p10, p12}, p10 -- p15, p15 -- c4, c4 -- p2, p2 -- p12, p12 -- p4};
};
13 Transformations: Mirroring

PGF Library \texttt{ext.transformations.mirror}

\begin{verbatim}
\usepgflibrary{ext.transformations.mirror} % \LaTeX{} and plain \TeX{}
\usepgflibrary{ext.transformations.mirror} % Con\TeX{}t
\end{verbatim}

This library adds mirror transformations to PGF.

Two approaches to mirror transformation exist:

1. Using the reflection matrix (see left column).
   This depends on \texttt{pgfpointnormalised} which involves the sine and the cosine functions of PGFmath.

2. Using built-in transformations (see right column).
   This depends on \texttt{pgfmathanglebetween} which involves the arctangent (\texttt{atan2}) function of PGFmath.

Which one is better? I don’t know. Choose one you’re comfortable with.

13.1 Using the reflection matrix

The following commands use the reflection matrix that sets the transformation matrix following

\[ A = \frac{1}{\|\vec{l}\|^2} \begin{bmatrix} l_x^2 - l_y^2 & 2l_xl_y \\ 2l_xl_y & l_y^2 - l_x^2 \end{bmatrix}. \]

\texttt{\pgftransformxmirror{(value)}}

Sets up a transformation that mirrors along a vertical line that goes through point \((\text{value}, 0)\).

\begin{tikzpicture}
\begin{scope}
\draw[help lines] (-0.25, -0.25) grid (3.25, 1.25);
\draw[-latex] (0,0) .. controls (.5,1) .. (1,1);
\draw[dashed] (1.5, -.25) -- (1.5, 1.25);
\pgftransformxmirror{1.5}
\draw[-latex] (0,0) .. controls (.5,1) .. (1,1);
\end{scope}
\end{tikzpicture}

13.2 Using built-in transformations

The following commands use a combination of shifting, rotating, \(-1\) scaling, rotating back and shifting back to reach the mirror transformation.

The commands are named the same as on the left side, only the \texttt{m} in \texttt{mirror} is capitalized.

\texttt{\pgftransformxMirror{(value)}}

Sets up a transformation that mirrors along a vertical line that goes through point \((\text{value}, 0)\).

\begin{tikzpicture}
\begin{scope}
\draw[help lines] (-0.25, -0.25) grid (3.25, 1.25);
\draw[-latex] (0,0) .. controls (.5,1) .. (1,1);
\draw[dashed] (1.5, -.25) -- (1.5, 1.25);
\pgftransformxMirror{1.5}
\draw[-latex] (0,0) .. controls (.5,1) .. (1,1);
\end{scope}
\end{tikzpicture}
\texttt{\textbackslash pgftransformmirror\{\textit{value}\}}

Sets up a transformation that mirrors along a horizontal line that goes through point $(0, \langle \textit{value} \rangle)$.

\texttt{\textbackslash pgftransformmirror\{\langle \textit{point A} \rangle\}\{\langle \textit{point B} \rangle\}}

Sets up a transformation that mirrors along the line that goes through $\langle \textit{point A} \rangle$ and $\langle \textit{point B} \rangle$.

\texttt{\textbackslash pgftransformmirror\{\langle \textit{point A} \rangle\}}

Sets up a transformation that mirrors along the line that goes through the origin and $\langle \textit{point A} \rangle$.

\texttt{\textbackslash pgfqtransformmirror\{\langle \textit{point A} \rangle\}}

Sets up a transformation that mirrors along the line that goes through the origin and $\langle \textit{point A} \rangle$. 

\texttt{\textbackslash usepgflibrary\{transformations.mirror\}}

\begin{tikzpicture}
\draw[help lines] (-.25, -2.25) grid (2.5, 1.25);
\draw[-latex] (0,0) .. controls (.5,1) .. (1,1);
\draw[dashed] (0, -1) -- (2, 0);
\pgftransformmirror{\pgfpointxy{0}{-1}}{\pgfpointxy{2}{ 0}}
\draw[-latex] (0,0) .. controls (.5,1) .. (1,1);
\end{tikzpicture}

\texttt{\textbackslash usepgflibrary\{transformations.mirror\}}

\begin{tikzpicture}
\draw[help lines] (-.25, -.25) grid (2.25, 1.25);
\draw[-latex] (0,0) .. controls (.5,1) .. (1,1);
\draw[dashed] (0, 0) -- (2, 1);
\pgfqtransformmirror{\pgfpointxy{2}{1}}
\draw[-latex] (0,0) .. controls (.5,1) .. (1,1);
\end{tikzpicture}
$$\phi^2 \{\Omega\}_{i=1}^n \partial \varphi$$

\usetikzlibrary{ext.misc}
\begin{tikzpicture}
\begin{scope}
\draw[fill=gray!50] (0,0) circle (1) arc (0:360:1);
\foreach \i in {0,1,...,20}
\filldraw[fill=gray!50] (\i/20*360:1) arc (\i/20*360:1+1/20*360:1) -- (\i/20*360+360:1) arc (\i/20*360+360:1:1) -- cycle;
\end{scope}
\node {$\phi^2$};
\node at (north west:{sqrt 2 * 1.5}) {$\{\Omega\}_{i=1}^n$};
\node [rotate=-0.5, right] at (-0.5:1.5) {$\partial \varphi$};
\end{tikzpicture}
14 Calendar: Weeknumbers and more conditionals

This package adds week numbers and more conditionals to the PGF package \pgfcalendar. (Despite the code example above, this package is not set up to work with Con\TeX{.})

14.1 Extensions

The following tests are added.

- \texttt{Jan} This test is passed by all dates that are in the month of January.
- \texttt{Feb} as above.
- \texttt{Mar} as above.
- \texttt{Apr} as above.
- \texttt{May} as above.
- \texttt{Jun} as above.
- \texttt{Jul} as above.
- \texttt{Aug} as above.
- \texttt{Sep} as above.
- \texttt{Oct} as above.
- \texttt{Nov} as above.
- \texttt{Dec} as above.
- \texttt{leap year}=(\texttt{year}) This test checks whether the given year is a leap year. If \langle \texttt{year} \rangle is omitted, it checks the year of the current date.
- \texttt{and}=(\langle \texttt{tests} \rangle) This test passes when all \langle \texttt{tests} \rangle pass.
- \texttt{not}=(\langle \texttt{tests} \rangle) This test passes when \langle \texttt{tests} \rangle do not pass.
- \texttt{yesterday}=(\langle \texttt{tests} \rangle) This test passes when the previous day passes \langle \texttt{tests} \rangle.
- \texttt{week}=(\texttt{num}) This test passes when the current week of the year equals \langle \texttt{num} \rangle.

The shorthands for \texttt{d-} and \texttt{m-} are slightly changed so that they are expandable. This makes it possible to use these shorthands inside of PGFmath. The shorthands for the week (see section 14.2) are added. These are

- \texttt{n-} (shortest numerical representation),
- \texttt{n=} (shortest but added horizontal space) and
- \texttt{n0} (leading zero when below 10).

14.2 Week numbering (ISO 8601)

\pgfcalendarjulianyeartoweek{(\texttt{Julian day})\langle \texttt{year} \rangle\langle \texttt{week counter} \rangle}

This command calculates the week for the \langle \texttt{Julian day} \rangle of \langle \texttt{year} \rangle. The \langle \texttt{week counter} \rangle must be a \TeX{} counter.

The calculation follows the rule of ISO 8601 where the first week has that year’s first Thursday in it.

Inside of \pgfcalendar the command \pgfcalendarcurrentweek will be available.

\pgfcalendarcurrentweek

This command returns the current week number (always two digits – use shorthand \texttt{n} to strip the leading zero).

Inside of \ifdate the command \pgfcalendarifdateweek will be available.

\pgfcalendarifdateweek

This command returns the week number (always two digits).
15   And a little bit more

TikZ Library ext.misc

\usetikzlibrary{ext.misc} % \LaTeX{} and plain \TeX{}
\usetikzlibrary{ext.misc} % Con\TeX{}

This library adds miscellaneous utilities to PGFmath, PGF or TikZ.

15.1   PGFmath

15.1.1   Postfix operator R

Similar to \segments\(<\text{num}>\) in PSTricks, the postfix operator R allows the user to use an arbitrary number of segments of a circle to be used instead of an angle.

	/tikz/full arc\(<\text{num}>\)\hspace{1cm} \text{(default)}

The number \(<\text{num}>\) of segments will be set up. Using full arc with an empty value disables the segmentation and 1R equals 1\(^\circ\).

The given value \(<\text{num}>\) is evaluated when the key is used and doesn’t change when \(<\text{num}>\) contains variables that change.

The \texttt{R} operator can then be used.

\texttt{xR} \hspace{1cm} \text{(postfix operator; uses the fullarc function)}

Multiplies \(x\) with \(\frac{360}{\text{num}}\).

15.1.2   Functions

\texttt{strrepeat("Text", \texttt{x})}
\texttt{\pgfmathstrrepeat{"Text"}{\texttt{x}}}

Returns a string with \texttt{Text} repeated \texttt{x} times.

\texttt{foofoofoofoofoo} \texttt{\pgfmathparse{strrepeat("foo", 5)}} \texttt{\pgfmathresult}

\texttt{isInString("String", "Text")}
\texttt{\pgfmathisInString{"String"}{"Text"}}

Returns 1 (true) if \texttt{Text} contains \texttt{String}, otherwise 0 (false).

\texttt{isNotEmpty("Text")}
\texttt{\pgfmathisempty{"Text"}}

Returns 1 (true) if \texttt{Text} is empty, otherwise 0 (false).

\texttt{0 and 1} \texttt{\pgfmathisstring{"foo", "bar"}} \texttt{\pgfmathresult \ and\}
\texttt{\pgfmathisstring{"foo", "foobar"}} \texttt{\pgfmathresult}

\texttt{strcat("Text A", "Text B", \_)}
\texttt{\pgfmathstrcat{"Text A"}{"Text B"}{\_}}

Returns the concatenation of all given parameters.

\texttt{blue!21!green} \texttt{\pgfmathparse{strcat("blue!", int(7*3), "!green")}} \texttt{\pgfmathresult}

\texttt{atanXY(x, y)}
\texttt{\pgfmathatanXY{x}{y}}

Arctangent of \(y \div x\) in degrees. This also takes into account the quadrant. This is just a argument-swapped version of \texttt{atan2} which makes it easier to use the \texttt{\p} commands of the \texttt{calc} library.

\texttt{53.13011} \texttt{\pgfmathresult \math{\text{atanXY}(3,4)}}
\textbf{15.1.3 Functions: using coordinates}

The following functions can only be used with PGF and/or TikZ. Since the arguments are usually plain text (and not numbers) one has to wrap them in ".

\texttt{\pgfmathanglebetween{"p1"}{"p2"}}

\begin{verbatim}
\usetikzlibrary{calc,ext.misc,through}
\begin{tikzpicture}
\path (0,0) coordinate (A) + (0:4) coordinate (B) +(75:4) coordinate (C);
\draw (A) -- (B) -- (C) -- cycle;
\foreach \cnt in {1,...,4}{
  \pgfmathsetmacro\triA{distancebetween("B","C")}
  \pgfmathsetmacro\triB{distancebetween("C","A")}
  \pgfmathsetmacro\triC{distancebetween("A","B")}
  \path (barycentric cs:A=\triA,B=\triB,C=\triC) coordinate (M)
    node [draw, circle through=($(A)!(M)!(C)$)] (M) {};
  \draw ($(C)-(A)$) coordinate (vecB)
    (M.75-90) coordinate (@)
    (intersection of @--[shift=(vecB)]@ and B--C) coordinate (C) --
    (intersection of @--[shift=(vecB)]@ and B--A) coordinate (A);}
\end{tikzpicture}
\end{verbatim}

15.2 PGFkeys

15.2.1 Conditionals

\texttt{/utils/if=⟨cond⟩⟨true⟩⟨false⟩ (no default)}

This key checks the conditional \(⟨\text{cond}⟩\) and applies the styles \(⟨\text{true}⟩\) if \(⟨\text{cond}⟩\) is true, otherwise \(⟨\text{false}⟩\). \(⟨\text{cond}⟩\) can be anything that PGFmath understands.

As a side effect on how PGFkeys parses argument, the \(⟨\text{false}⟩\) argument is actually optional.

\texttt{/utils/TeX/if=⟨token A⟩⟨token B⟩⟨true⟩⟨false⟩ (no default)}

The following keys use \TeX’ macros \texttt{\if}, \texttt{\ifx}, \texttt{\ifnum} and \texttt{\ifdim} for faster executions.
This key checks via `\if` if \(\langle \text{token A} \rangle\) matches \(\langle \text{token B} \rangle\) and applies the styles \(\langle \text{true} \rangle\) if it does, otherwise \(\langle \text{false} \rangle\).

As a side effect on how PGFkeys parses argument, the \(\langle \text{false} \rangle\) argument is actually optional.

\[
/\text{utils/TeX/} \text{ifx}=(\text{token A})(\text{token B})(\text{true})(\text{false})
\]
(no default)

As above.

\[
/\text{utils/TeX/} \text{ifnum}=(\text{num cond})(\text{true})\text{opt}(\text{false})
\]
(no default)

This key checks `\ifnum (num cond)` and applies the styles \(\langle \text{true} \rangle\) if true, otherwise \(\langle \text{false} \rangle\). A delimiting `\relax` will be inserted after \(\langle \text{num cond} \rangle\).

As a side effect on how PGFkeys parses argument, the \(\langle \text{false} \rangle\) argument is actually optional.

\[
/\text{utils/TeX/} \text{idim}=(\text{dim cond})(\text{true})(\text{false})
\]
(no default)

As above.

\[
/\text{utils/TeX/} \text{ifempty}=(\text{Text})(\text{true})(\text{false})
\]
(no default)

This checks whether \(\langle \text{Text} \rangle\) is empty and applies styles \(\langle \text{true} \rangle\) if true, otherwise \(\langle \text{false} \rangle\).

15.2.2 Handlers

While already a lot of values given to keys are evaluated by PGFmath at some point, not all of them are.

**Key handler** \(\langle \text{key} \rangle/.pgfmath=\langle \text{eval} \rangle\)

This handler evaluates \(\langle \text{eval} \rangle\) before it is handed to the key.

**Key handler** \(\langle \text{key} \rangle/.pgfmath int=\langle \text{eval} \rangle\)

As above but truncates the result.

**Key handler** \(\langle \text{key} \rangle/.pgfmath strcat=\langle \text{eval} \rangle\)

As above but uses the `strcat` function.

In the example below, one could have used the `/pgf/foreach/evaluate` key from `\foreach`.

```
\usetikzlibrary {misc}
\tikz\foreach \i in {0,10,...,100}
\draw[\line width=+.2cm,\color/.pgfmath strcat=\"red!,sqrt(\i)*10,\"!blue\"]
(0,\i/50) -- +(right:3);
```

**Key handler** \(\langle \text{key} \rangle/.\text{List}=\langle \langle e1 \rangle, \langle e2 \rangle, ..., \langle en \rangle \rangle\)

This handler evaluates the given list with `\foreach` and concatenates the element and the result is then given to the used key.
15.3 \textbf{PGFfor}

Instead of \texttt{\foreach \var in \{start, start + delta, \ldots, end\}} one can use \texttt{\foreach \var[use int=start to end step delta]}.

\texttt{/pgf/foreach/use \texttt{int=\{start\}to\(end\)step\(delta\)}}

The values \texttt{\(start\)}, \texttt{\(end\)} and \texttt{\(delta\)} are evaluates by PGFmath at initialization. The part \texttt{\texttt{\texttt{step}} \(delta\)} is optional (\texttt{\(\delta\)} = 1).

\texttt{/pgf/foreach/use \texttt{float=\{start\}to\(end\)step\(delta\)}}

Same as above, however the results are not truncated.

35
Part V
Changelog & Index

Changelog

Version 0.2
• Added Ti\kZ library ext.positioning-plus.
• Added Ti\kZ library ext.node-families.

Version 0.1
• Added Ti\kZ library ext.calendar-plus.
• Added Ti\kZ library ext.misc.
• Added Ti\kZ library ext.paths.arcto.
• Added Ti\kZ library ext.paths.ortho.
• Added Ti\kZ library ext.paths.timer.
• Added Ti\kZ library ext.patterns.images.
• Added Ti\kZ library ext.topaths.arcthrough.
• Added Ti\kZ library ext.transformations.mirror.
• Added PGF library ext.transformations.mirror.
This index contains automatically generated entries as well as references to original functionalities of PGF/Ti\kZ.

| | path operation, 11
| \hline | \hline \hline | path operation, 11
| \hline \hline \hline | path operation, 11
| \hline \hline \hline | path operation, 11
\hline
above key, 20
above left key, 18
above right key, 18
\hline
and date test, 31
angle between math function, 33
Apr date test, 31
arc through key, 23
arc to path operation, 9
atan2 math function, 28, 32
atanXY math function, 32
atanYX math function, 33
Aug date test, 31
\hline
below key, 20
below left key, 18
below right key, 18
\hline
calc library, 32
calendar library, 6
calendar-ext package, 31
center suffix key, 23
circle shape, 7
clockwise key, 9, 23
corner above left key, 18
corner above right key, 18
corner below left key, 18
corner below right key, 18
corner east above key, 21
corner east below key, 21
corner north left key, 21
corner north right key, 21
cos math function, 28
cos path operation, 16
counter clockwise key, 10, 23
\hline
Date tests
and, 31
Apr, 31
Aug, 31
Dec, 31
Feb, 31
Jan, 31
Jul, 31
Jun, 31
leap year, 31
Mar, 31
May, 31
not, 31
Nov, 31
Oct, 31
Sep, 31
week, 31
yesterday, 31
day code key, 6
day text key, 6
day xshift key, 6
day yshift key, 6
Dec date test, 31
distance key, 11, 14
distance between math function, 33
du distance key, 13
east above key, 20
east below key, 20
date test, 31
edge path operation, 23
every arc to key, 10
every day key, 6
every month key, 6
every week key, 6
execute at end picture key, 7
ext.calendar-plus library, 6
ext.misc library, 32
ext.node-families library, 7
ext.paths.arcto library, 9
ext.paths.ortho library, 11
ext.paths.timer library, 15
ext.patterns.images library, 17
ext.positioning-plus library, 18
ext.topaths.arcthrough library, 23
ext.transformations.mirror library, 24, 28
external library, 7
Feb date test, 31
fit library, 18
fit bounding box key, 22
from center key, 12, 14
full arc key, 32
height key, 7
horizontal key, 14
horizontal horizontal key, 14
if key, 6, 33
\ifdate, 31
ifdim key, 34
ifempty key, 34
ifnum key, 34
ifx key, 34
image as pattern key, 17
isNotEmpty math function, 32
isInString math function, 32
Jan date test, 31
Jul date test, 31
Jun date test, 31
Key handlers
.List, 34
\pgfmath, 34
\pgfmath int, 34
\pgfmath strcat, 34
large key, 10
leap year date test, 31
left key, 19, 20
Libraries
calc, 32
calendar, 6
ext.calendar-plus, 6
ext.misc, 32
ext.node-families, 7
ext.paths.arcto, 9
ext.paths.ortho, 11
ext.paths.timer, 15
ext.patterns.images, 17
ext.positioning-plus, 18
ext.topaths.arcthrough, 23
ext.transformations.mirror, 24, 28
external, 7
fit, 18
positioning, 18
.List handler, 34
lr distance key, 13
Mar date test, 31
Math functions
anglebetween, 33
atan2, 28, 32
atanXY, 32
atanYX, 33
cos, 28
distancebetween, 33
isNotEmpty, 32
isInString, 32
qanglebetween, 33
qdistancebetween, 33
sin, 28
strcat, 32
strrepeat, 32
Math operators
R, 32
May date test, 31
middle 0 to 1 key, 13
minimum height key, 7
minimum width key, 7
Mirror key, 26
mirror key, 25
Mirror x key, 26
mirror x key, 25
Mirror y key, 26
mirror y key, 25
month code key, 6
month text key, 6
month xshift key, 6
month yshift key, 6
name key, 17
north left key, 19
north right key, 20
not date test, 31
Nov date test, 31
Oct date test, 31
on grid key, 22
only horizontal first key, 14
only horizontal second key, 14
only vertical first key, 14
only vertical second key, 14
option key, 17
options key, 17

Packages and files
calendar-ext, 31
parabola path operation, 15
Path operations
|-|, 11
-|-|, 11
-|-|, 11

/\pgf/
foreach/  
\use float, 35
\use int, 35
minimum height, 7
minimum width, 7
text, 17
\pgfcalendar, 31
\pgfcalendarcurrentweek, 31
\pgfcalendarifdateweek, 31
\pgfcalendarjulianyearartoekweek, 31
\pgfmath handler, 34
\pgfmath int handler, 34
\pgfmath strcat handler, 34
\pgfmathanglebetween, 33
\pgfmathanglebetween, 28
\pgfmathatanXY, 32
\pgfmathatanYX, 33
\pgfmathdistancebetween, 33
\pgfmathis Empty, 32
\pgfmathis InString, 32
\pgfmathqanglebetween, 33
\pgfmathqdistancebetween, 33
\pgfmathstrcat, 32
\pgfmathstrrepeat, 32
pgfminimum height, 22
pgfminimum height key, 22
pgfminimum width, 22
pgfminimum width key, 22
\pgfpatharcto, 10
\pgfpointnormalised, 28
\pgftransformmirror, 29
\pgftransformmirror, 29
\pgfsetupimageaspattern, 17
\pgftransformmirror, 29
\pgftransformmirror, 29
\pgftransformxmirror, 28
\pgftransformymirror, 29
pos key, 12, 15
positioning library, 18
prefix key, 8
qanglebetween math function, 33
qdistancebetween math function, 33

R postfix math operator, 32
r-du path operation, 13
r-lr path operation, 13
r-rl path operation, 13
r-ud path operation, 13
radius key, 10
ratio key, 11
rectangle path operation, 15
rectangle shape, 7
right key, 20
rl distance key, 13
rotate key, 10

Sep date test, 31
setup shape key, 8
Shapes
circle, 7
rectangle, 7
sin math function, 28
sin path operation, 16
size key, 7
small key, 10

south left key, 20
south right key, 20
spacing key, 12
span key, 22
span horizontal key, 22
span vertical key, 22
strcat math function, 32
strrepeat math function, 32
text key, 17
text key, 8
text depth key, 7
text height key, 7
text width key, 8
text width align key, 8
through key, 23

/tikz/
above, 20
above left, 18
above right, 18
arc through/
  center suffix, 23
clockwise, 23
counter clockwise, 23
through, 23
arc through, 23
arc to/
clockwise, 9
counter clockwise, 10
large, 10
radius, 10
rotate, 10
small, 10
x radius, 10
y radius, 10
below, 20
below left, 18
below right, 18
corner above left, 18
corner above right, 18
corner below left, 18

circle, 7
rectangle, 7
sin math function, 28
sin path operation, 16
size key, 7
small key, 10

R postfix math operator, 32
r-du path operation, 13
r-lr path operation, 13
r-rl path operation, 13
r-ud path operation, 13
radius key, 10
ratio key, 11
rectangle path operation, 15
rectangle shape, 7
right key, 20
rl distance key, 13
rotate key, 10

Sep date test, 31
setup shape key, 8
Shapes
circle, 7
rectangle, 7
sin math function, 28
sin path operation, 16
size key, 7
small key, 10

south left key, 20
south right key, 20
spacing key, 12
span key, 22
span horizontal key, 22
span vertical key, 22
strcat math function, 32
strrepeat math function, 32
text key, 17
text key, 8
text depth key, 7
text height key, 7
text width key, 8
text width align key, 8
through key, 23

/tikz/
above, 20
above left, 18
above right, 18
arc through/
  center suffix, 23
clockwise, 23
counter clockwise, 23
through, 23
arc through, 23
arc to/
clockwise, 9
counter clockwise, 10
large, 10
radius, 10
rotate, 10
small, 10
x radius, 10
y radius, 10
below, 20
below left, 18
below right, 18
corner above left, 18
corner above right, 18
corner below left, 18
week code, 6
week label left, 6
week text, 6
west above, 20
west below, 20
x radius, 10
xMirror, 26
xmirror, 24
y radius, 10
yMirror, 26
ymirror, 25
to path operation, 23
to path key, 14
ud distance key, 13
use float key, 35
use int key, 35
/utils/
  if, 33
TeX/
  if, 33
ifdim, 34
ifempty, 34
ifnum, 34
ifx, 34

vertical horizontal key, 14
vertical horizontal vertical key, 14

week date test, 31
week code key, 6
week label left key, 6
week text key, 6
west above key, 20
west below key, 20
width key, 7
x radius key, 10
x radius key, 10
xMirror key, 26
xmirror key, 24
y radius key, 10
y radius key, 10
yesterday date test, 31
yMirror key, 26
ymirror key, 25