LaTeX Overlay Techniques: A Comprehensive Guide

Beamer Presentations and Regular Documents

LaTeX Overlay Reference

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Contents

1 Introduction

This document provides a comprehensive guide to overlay techniques in LaTeX, covering both beamer presentations and regular documents. Overlays allow you to create dynamic content, layer elements, and build sophisticated visual effects.

2 Part 1: Beamer Overlays

2.1 Basic Concepts

In beamer, overlays allow you to control when content appears on slides. The fundamental concept is the *slide number* within a frame.

2.1.1 Example Beamer Code

```
\documentclass{beamer}
\begin{document}
\begin{frame}{Basic Pause}
    First item
    \pause
    Second item appears after pause
    \pause
    Third item appears last
\end{frame}
\end{document}
```

2.2 Basic Pause Commands

The \pause command is the simplest overlay mechanism:

```
\begin{frame}{Incremental Reveals}
    \begin{itemize}
        \item First point
        \pause
        \item Second point appears next
        \pause
        \item Third point appears last
    \end{itemize}
\end{frame}
```

2.3 Overlay Commands

2.3.1 \only

Shows content only on specified slides:

```
\only<1>{This appears only on slide 1}
\only<2>{This replaces it on slide 2}
\only<3->{This appears from slide 3 onwards}
```

2.3.2 \uncover

Reveals content while reserving space:

```
\uncover<2->{This text is invisible on slide 1 but takes up space}
\uncover<1,3>{Visible on slides 1 and 3 only}
```

2.3.3 \visible

Similar to `\uncover` but with different spacing behavior:

```
\visible<2->{Visible from slide 2}
\visible<-3>{Visible until slide 3}
```

2.3.4 \invisible

Opposite of `\visible`:

```
\invisible<2-4>{Hidden on slides 2 through 4}
```

2.3.5 \alt

Alternates between two contents:

```
\alt<2>{Content on slide 2}{Content on other slides}
\alt<3->{Final content}{Initial content}
```

2.4 Overlay Specifications

2.4.1 Basic Specifications

- `<1>` - Only on slide 1
- `<1->` - From slide 1 onwards
- `<-3>` - Until slide 3
- `<2-4>` - From slide 2 to 4
- `<1,3,5>` - On slides 1, 3, and 5

2.4.2 Relative Specifications

- `<+->` - From next slide onwards
- `<.->` - From current slide onwards
- `<+(1)->` - From slide after next onwards

```
\begin{frame}{Relative Overlays}
    \begin{itemize}[<+->]
        \item First item
        \item Second item (automatic increment)
        \item Third item (automatic increment)
    \end{itemize}
\end{frame}
```

2.5 Dynamic Highlighting

2.5.1 \alert

Highlights text on specified slides:

```
\alert<2>{This text is highlighted on slide 2}
\alert<3->{Highlighted from slide 3 onwards}
```

2.5.2 \action

General action command:

```
\action<2>{\color{red}}{Text becomes red on slide 2}
\action<3->{\textbf}{Text becomes bold from slide 3}
```

2.6 Overlays with Lists

```
% Automatic incremental lists
\begin{itemize}[<+->]
    \item First item
    \item Second item
    \item Third item
\end{itemize}

% Custom overlay specifications
\begin{enumerate}[<+-| alert@+>]
    \item First item (alerted when appearing)
    \item Second item (alerted when appearing)
    \item Third item (alerted when appearing)
\end{enumerate}

% Mixed specifications
\begin{itemize}
    \item<1-> Always visible
    \item<2-> Appears on slide 2
    \item<3-> \alert<4>{Appears on 3, highlighted on 4}
\end{itemize}
```

2.7 TikZ Overlays in Beamer

```
\begin{frame}{TikZ with Overlays}
    \begin{tikzpicture}
        % Node appears on slide 1
        \node<1-> (a) at (0,0) {Node A};

        % Node appears on slide 2
        \node<2-> (b) at (2,0) {Node B};

        % Arrow appears on slide 3
        \draw<3-> [->] (a) -- (b);

        % Highlighted on slide 4
        \node<4> [fill=yellow] at (1,-1) {Highlight!};
    \end{tikzpicture}
\end{frame}

% Using visible on style
\begin{frame}{TikZ Visible On}
    \begin{tikzpicture}
        \node[visible on=<1->] {Always visible};
        \node[visible on=<2->] at (0,-1) {From slide 2};
        \node[visible on=<3>] at (0,-2) {Only on slide 3};

        % Alternative syntax
        \draw[visible on=<2-3>] (0,0) circle (1cm);
```

```
    \end{tikzpicture}
\end{frame}
```

2.8 \temporal Command

The `\temporal` command provides three alternatives:

```
\temporal<2>{Before}{During}{After}
\temporal<2-4>{Initial}{Highlighted}{Final}

% Example with formatting
\temporal<2-3>
    {\color{gray}Text}     % Before slides 2-3
    {\color{red}\textbf{Text}}  % During slides 2-3
    {\color{blue}Text}      % After slide 3
```

2.9 Handout Mode

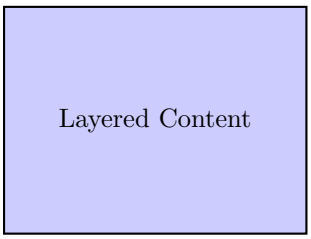
```
% In preamble
\documentclass[handout]{beamer}

% Handout-specific content
\only<beamer>{This only appears in presentation mode}
\only<handout>{This only appears in handout mode}

% Selecting specific slides for handout
\only<beamer:1-3|handout:2>{Slides 1-3 in beamer, slide 2 in handout}
```

3 Part 2: Overlays in Regular LaTeX Documents

3.1 TikZ Overlays and Layers

TikZ provides powerful overlay capabilities in regular documents:

3.1.1 Basic TikZ Overlays




```
\begin{tikzpicture}[remember picture,overlay]
    % Draw on top of the page
    \draw[red,thick] (current page.north west) -- (current page.south east);
    \node[rotate=45] at (current page.center) {\Huge DRAFT};
\end{tikzpicture}
```

3.1.2 TikZ Layers

```
\pgfdeclarelayer{background}
\pgfdeclarelayer{foreground}
\pgfsetlayers{background,main,foreground}

\begin{tikzpicture}
    \begin{pgfonlayer}{background}
        \fill[yellow!30] (0,0) rectangle (3,2);
    \end{pgfonlayer}

    \draw (0,0) rectangle (3,2);
    \node at (1.5,1) {Main layer};

    \begin{pgfonlayer}{foreground}
        \draw[red,thick] (0,0) -- (3,2);
    \end{pgfonlayer}
\end{tikzpicture}
```

3.2 Spacing Overlays with \phantom

3.2.1 Basic phantom

Text with phantom: X X

Text without phantom: XX

```
% Horizontal spacing
Before\phantom{invisible text}After

% Vertical spacing
Line 1\\
\vphantom{\Huge Big}Line 2\\
Line 3
```

3.2.2 Mathematical phantoms

$$\frac{a}{c} \quad \text{vs} \quad \frac{a}{c}$$

3.3 Text Overlapping Commands

3.3.1 \llap, \rlap, \clap

Right overlap: Text overlapping

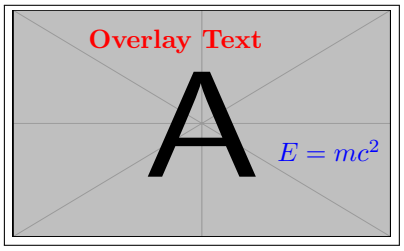
Left overlap: Text continues

Center overlap: Text continues

```
% Right overlap (zero width, extends right)
Normal\rlap{\color{red} Overlapped} Text

% Left overlap (zero width, extends left)
Normal \llap{\color{blue}Overlapped}Text

% Center overlap
Normal\clap{\rule{3cm}{0.5pt}}Text
```

3.4 The overpic Package

```
\usepackage{overpic}

% Basic usage (requires an image file)
\begin{overpic}[width=5cm,grid,tics=10]{example-image}
    \put(20,30){\color{red}Label 1}
    \put(60,70){\color{blue}\Large Label 2}
    \put(10,10){\rotatebox{45}{Rotated}}
\end{overpic}
```



3.5 The textpos Package

```
\usepackage[absolute,overlay]{textpos}
\setlength{\TPHorizModule}{1cm}
\setlength{\TPVertModule}{1cm}

% Absolute positioning
\begin{textblock}{5}(10,5)
    This text block is 5cm wide, positioned at (10cm,5cm)
\end{textblock}

% Overlay example
\begin{textblock}{3}[0.5,0.5](8,4)
    \colorbox{yellow}{Floating Box}
\end{textblock}
```

3.6 Using tikzmark

```
\usepackage{tikz}
\usetikzlibrary{tikzmark,calc}

% Mark positions in text
This is \tikzmark{start}important\tikzmark{end} text.

% Draw connections
\begin{tikzpicture}[remember picture,overlay]
    \draw[red,thick]
        ([yshift=2pt]pic cs:start) rectangle ([yshift=-2pt]pic cs:end);
\end{tikzpicture}
```

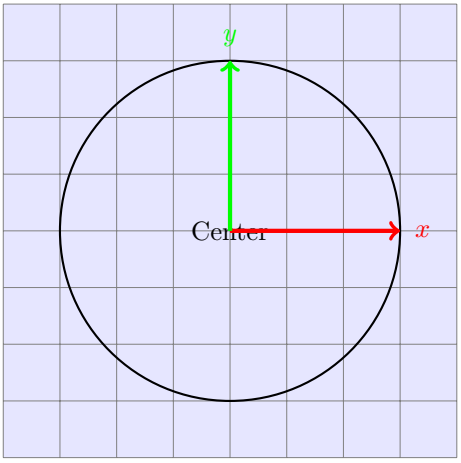
Example: Mark this and that.

3.7 The animate Package

```
\usepackage{animate}

% Create frame-by-frame animation
\begin{animateinline}[controls,loop]{2}
    % Frame 0
    \begin{tikzpicture}
        \draw (0,0) circle (1);
        \fill (0,0) circle (0.1);
    \end{tikzpicture}
\newframe
    % Frame 1
    \begin{tikzpicture}
        \draw (0,0) circle (1);
        \fill (45:1) circle (0.1);
    \end{tikzpicture}
\newframe
    % Frame 2
    \begin{tikzpicture}
        \draw (0,0) circle (1);
        \fill (90:1) circle (0.1);
    \end{tikzpicture}
\end{animateinline}
```

3.8 Multi-layer Diagrams

3.8.1 Complex Layer Example



4 Advanced Techniques

4.1 Combining Multiple Overlay Methods

```
% Complex overlay with TikZ and textpos
\begin{textblock}{5}(10,15)
    \begin{tikzpicture}
        \node[draw,rounded corners,fill=yellow!30] {
            \parbox{4cm}{
                This combines textpos for positioning
                with TikZ for styling.
            }
```

```
        };
    \end{tikzpicture}
\end{textblock}

% Overlay with mathematical content
\[
    \underbrace{a + b}_{\text{\clap{sum}}} =
    \overbrace{c}^{\text{\rlap{result}}}
\]
```

4.2 Creating Watermarks

```
% Page-wide watermark
\usepackage{eso-pic}
\AddToShipoutPictureBG{%
    \begin{tikzpicture}[remember picture,overlay]
        \node[rotate=45,scale=10,text opacity=0.1]
            at (current page.center) {DRAFT};
    \end{tikzpicture}%
}
```

4.3 Overlay Effects in Tables

```
\begin{tabular}{|c|c|c|}
    \hline
    A & B & C \\
    \hline
    1 & 2 & 3 \\
    \hline
    \multicolumn{2}{|c|}{\cellcolor{yellow}Merged} & 6 \\
    \hline
\end{tabular}

% With TikZ overlay
\begin{tikzpicture}[remember picture]
    \node[inner sep=0pt] (table) {
        \begin{tabular}{|c|c|c|}
            \hline
            A & B & C \\
            \hline
            1 & \tikzmark{cell}2 & 3 \\
            \hline
        \end{tabular}
    };
    \begin{scope}[overlay]
        \draw[red,thick,->] (cell) -- ++(1,0.5)
            node[right] {Important!};
    \end{scope}
\end{tikzpicture}
```

5 Best Practices

5.1 Beamer Overlays

1. Use \pause for simple sequential reveals

2. Prefer `\only` when content should not affect spacing
3. Use `\uncover` to maintain consistent layout
4. Apply `[<+->]` to lists for automatic incrementing
5. Consider handout mode when designing overlays
6. Test presentations with different overlay densities

5.2 Document Overlays

1. Use `remember picture,overlay` for page-wide effects
2. Define layers for complex diagrams
3. Combine `\phantom` with math for alignment
4. Use `textpos` for absolute positioning needs
5. Apply `tikzmark` for connecting distant elements
6. Test PDF compatibility when using animations

6 Troubleshooting

6.1 Common Issues

- **Overlapping content**: Check layer ordering
- **Missing overlays**: Compile twice for TikZ overlays
- **Animation not working**: Ensure PDF viewer supports JavaScript
- **Textpos positioning**: Verify module settings
- **Beamer handout**: Use mode-specific commands

7 Conclusion

This guide has covered comprehensive overlay techniques for both beamer presentations and regular LaTeX documents. From simple reveals to complex multi-layer diagrams, these tools provide powerful ways to create dynamic and visually appealing documents.

Key takeaways:

- Beamer provides specialized overlay commands for presentations
- TikZ offers flexible layering for both document types
- Multiple packages can be combined for advanced effects
- Always consider the output format and viewer capabilities

A Quick Reference

A.1 Beamer Overlay Commands

Command	Purpose
`\pause`	Simple sequential reveal
`\only<n>{...}`	Show only on slide(s) n
`\uncover<n>{...}`	Reveal on slide(s) n (space reserved)
`\visible<n>{...}`	Make visible on slide(s) n
`\invisible<n>{...}`	Make invisible on slide(s) n
`\alt<n>{A}{B}`	Show A on n, B otherwise
`\temporal<n>{A}{B}{C}`	A before n, B during n, C after
`\alert<n>{...}`	Highlight on slide(s) n

A.2 Regular Document Overlay Tools

Package/Command	Purpose
TikZ layers	Multi-layer drawings
`\phantom{...}`	Invisible space reservation
`\rlap{...}`, `\llap{...}`	Zero-width overlaps
overpic	Overlay on images
textpos	Absolute positioning
tikzmark	Mark and connect points
animate	PDF animations