

LatexGenC++ - Detailed Documentation

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Introduction

LatexGenC++ is a C++ library that enables programmatic generation of LaTeX documents. The library offers an object-oriented approach to create different types of LaTeX documents, including scientific articles, technical reports, books, and Beamer presentations.

The main objective of LatexGenC++ is to simplify the creation of LaTeX documents using C++ code, which is particularly useful in cases where document content needs to be dynamically generated from data or

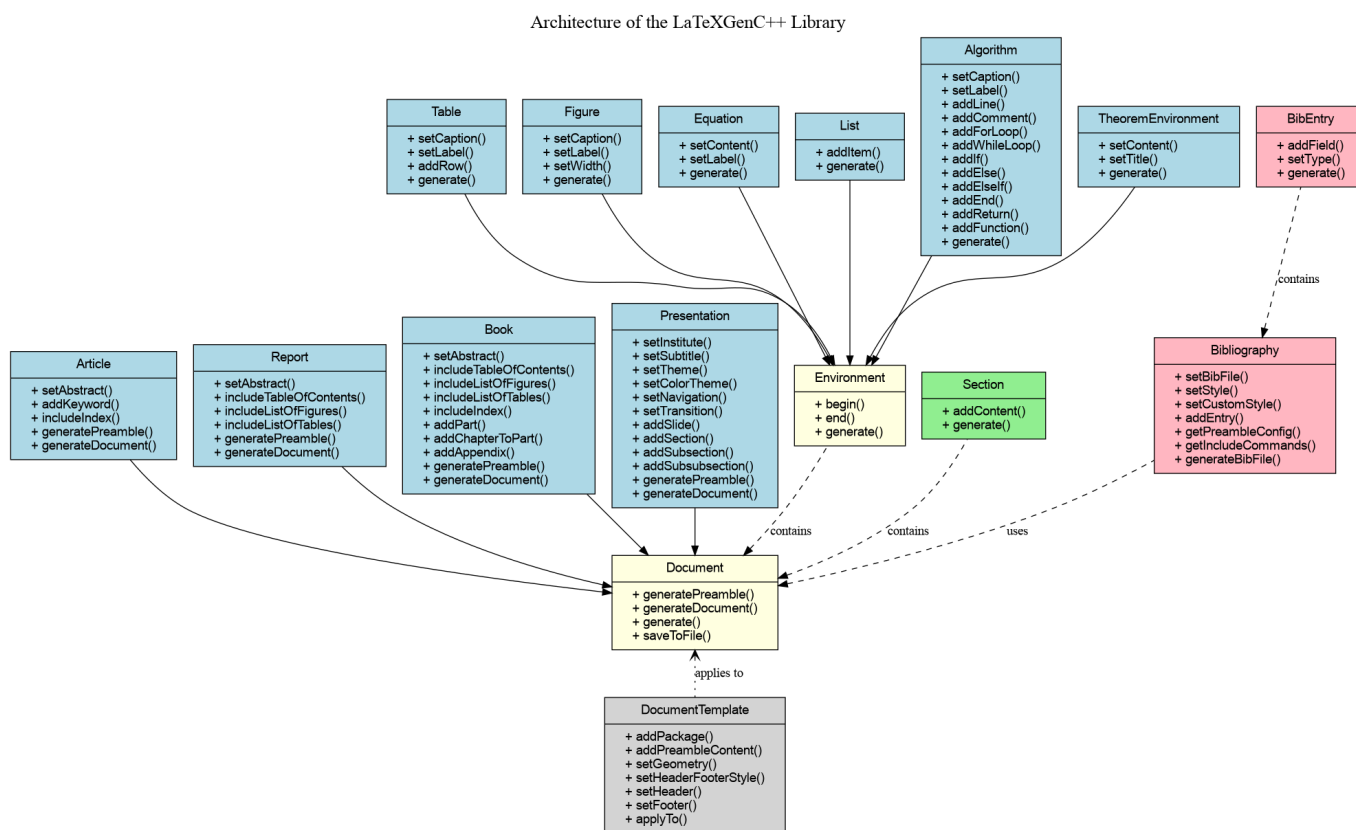
calculations.

Library Architecture

LatexGenC++ is designed using an object-oriented architecture, with a class hierarchy that reflects the different types of LaTeX documents and elements.

The base `Document` class defines the common interface for all document types, while derived classes such as `Article`, `Report`, `Book`, and `Presentation` implement functionality specific to each document type.

Content elements like tables, figures, equations, etc., are managed by classes derived from the base `Environment` class.



Document Types

Article

The `Article` class corresponds to the LaTeX `article` document type. It is suitable for scientific articles, short documents, and academic publications.

```

// Creating an article
Article article("Document Title", "Author Name", "Date");

// Adding an abstract
article.setAbstract("This is the abstract of the article...");

// Adding keywords
article.addKeyword("LaTeX");
article.addKeyword("C++");
  
```

Report

The `Report` class corresponds to the LaTeX `report` document type. It is designed for longer documents with chapters, such as technical reports or theses.

```
// Creating a report
Report report("Report Title", "Author Name", "Date");

// Enabling table of contents
report.includeTableOfContents(true);

// Enabling lists of figures and tables
report.includeListOfFigures(true);
report.includeListOfTables(true);
```

Book

The `Book` class corresponds to the LaTeX `book` document type. It is intended for voluminous documents with parts, chapters, and various front and back matter elements.

```
// Creating a book
Book book("Book Title", "Author Name", "Date");

// Adding a part
book.addPart("First Part");

// Adding a chapter to a part (index 0 = first part)
Section chapter("Chapter 1", Section::Level::CHAPTER);
book.addChapter(chapter, 0);

// Adding an appendix
Section appendix("Appendix A", Section::Level::CHAPTER);
book.addAppendix(appendix);
```

Presentation

The `Presentation` class corresponds to the LaTeX `beamer` document type. It allows you to create presentations for conferences or lectures.

```
// Creating a presentation
Presentation presentation("Presentation Title", "Author Name", "Date");

// Configuring the theme
presentation.setTheme(PresentationTheme::MADRID);
presentation.setColorTheme(PresentationColorTheme::BEAVER);
presentation.setTransition(PresentationTransition::FADE);
```

```
// Adding a slide
auto slide = std::make_shared<Slide>("Slide Title");
slide->addContent("Slide Content");
presentation.addSlide(slide);

// Creating the structure (true = create a slide for this section)
presentation.addSection("Introduction", true);
presentation.addSubsection("Context", false);
```

Content Structure

Sections, Subsections and Paragraphs

The `Section` class allows you to create sections, subsections, and subsubsections in documents.

```
// Creating a section
Section section("Section Title", Section::Level::SECTION);

// Creating a subsection
Section subsection("Subsection Title", Section::Level::SUBSECTION);

// Creating a subsubsection
Section subsubsection("Subsubsection Title",
Section::Level::SUBSUBSECTION);

// Adding content to a section
section.addContent("Section text...");

// Adding a subsection to a section
section.addContent(subsection.generate());

// Adding the section to the document
document.addSection(section);
```

Chapters and Parts

For reports and books, you can use chapters and parts.

```
// Creating a chapter
Section chapter("Chapter Title", Section::Level::CHAPTER);

// For books, you can organize chapters into parts
book.addPart("Part Title");
book.addChapter(chapter, 0); // Adds the chapter to the first part
```

Appendices

Appendices are available for reports and books.

```
// Creating an appendix
Section appendix("Appendix Title", Section::Level::CHAPTER);

// Adding the appendix to the document
book.addAppendix(appendix);
// or
report.addAppendix(appendix);
```

Content Elements

Text and Formatting

You can add formatted text to sections using the `addContent` method.

```
// Adding plain text
section.addContent("Normal text.");

// Adding text with LaTeX commands
section.addContent("Text in \\textbf{bold} and in \\textit{italic}.");

// Adding raw LaTeX content
document.addRowContent("\\clearpage");
```

Lists

The `List` class allows you to create different types of lists.

```
// Creating a bulleted list
auto itemize = std::make_shared<List>(List::ListType::ITEMIZE);
itemize->addItem("First item");
itemize->addItem("Second item");

// Creating a numbered list
auto enumerate = std::make_shared<List>(List::ListType::ENUMERATE);
enumerate->addItem("Step 1");
enumerate->addItem("Step 2");

// Creating a description list
auto description = std::make_shared<List>(List::ListType::DESCRIPTION);
description->addItem("Term 1", "Definition 1");
description->addItem("Term 2", "Definition 2");

// Adding the list to a section
section.addContent(itemize->generate());
```

You can also use the convenience methods provided by document classes:

```
// Using the addList method
auto list = document.addList(List::ListType::ITEMIZE);
list->addItem("Item 1");
list->addItem("Item 2");
```

Tables

The `Table` class allows you to create tables with headers and content.

```
// Creating column headers
std::vector<std::string> headers = {"Column 1", "Column 2", "Column 3"};

// Creating the table
auto table = std::make_shared<Table>(headers);
table->setCaption("Table Caption");
table->setLabel("tab:example");

// Adding rows
table->addRow({"Value 1.1", "Value 1.2", "Value 1.3"});
table->addRow({"Value 2.1", "Value 2.2", "Value 2.3"});

// Adding the table to a section
section.addContent(table->generate());
```

You can also use the convenience method:

```
// Using the addTable method
auto table = document.addTable(
    headers,                // Column headers
    "Table Caption",        // Caption
    "tab:example",          // Label for reference
    "htbp"                  // Position
);

// Adding rows
table->addRow({"Value 1.1", "Value 1.2", "Value 1.3"});
```

Figures

The `Figure` class allows you to insert images into documents.

```
// Creating a figure
auto figure = std::make_shared<Figure>("path/to/image.png");
figure->setCaption("Figure Caption");
```

```
figure->setLabel("fig:example");
figure->setWidth("0.7\\textwidth");

// Adding the figure to a section
section.addContent(figure->generate());
```

You can also use the convenience method:

```
// Using the addFigure method
auto figure = document.addFigure(
    "path/to/image.png",      // Image path
    "Figure Caption",        // Caption
    "fig:example",           // Label for reference
    "0.7\\textwidth",        // Width
    "htbp"                   // Position
);
```

Equations

The `Equation` class allows you to add mathematical equations.

```
// Creating an equation
auto equation = std::make_shared<Equation>("E = mc^2");
equation->setLabel("eq:einstein");
equation->setNumbered(true);

// Adding the equation to a section
section.addContent(equation->generate());
```

You can also use the convenience methods:

```
// Using the addEquation method
auto equation = document.addEquation(
    "E = mc^2",              // Equation content
    "eq:einstein",          // Label for reference
    true                     // Numbered equation
);

// Adding an inline equation
std::string inlineEq = document.addInlineEquation("F = ma");
document.addRowContent("The formula " + inlineEq + " is Newton's second law.");
```

Theorems

The `TheoremEnvironment` class allows you to create theorem environments.

```
// Creating a theorem
auto theorem = document.addTheorem(
    TheoremEnvironment::Type::THEOREM,    // Theorem type
    "A + B = B + A",                      // Theorem content
    "Commutativity of Addition"           // Theorem title (optional)
);
```

Different theorem types are available:

- **THEOREM**: Theorem
- **LEMMA**: Lemma
- **COROLLARY**: Corollary
- **PROPOSITION**: Proposition
- **DEFINITION**: Definition
- **EXAMPLE**: Example
- **REMARK**: Remark
- **PROOF**: Proof

Algorithms

The **Algorithm** class allows you to create formatted algorithm descriptions.

```
// Creating an algorithm
auto algorithm = document.addAlgorithm(
    "Bubble Sort",          // Caption
    "algo:bubblesort"       // Label
);

// Configuring the algorithm
algorithm->addFunction("BubbleSort", "A : array of integers");
algorithm->addForLoop("i = 1 \\textbf{to} size(A)", 1);
algorithm->addForLoop("j = 1 \\textbf{to} size(A) - i", 2);
algorithm->addIf("A[j] > A[j+1]", 3);
algorithm->addLine("swap A[j] and A[j+1]", 4);
algorithm->addEnd("If", 3);
algorithm->addEnd("For", 2);
algorithm->addEnd("For", 1);
algorithm->addReturn("A", 1);
algorithm->addFunctionEnd(0);
```

Bibliography

LatexGenC++ offers two approaches for managing bibliographies:

Using an External .bib File

This approach uses an existing .bib file:


```
// Creating a bibliography from an external file
Bibliography biblio("references", BibStyle::IEEE);

// Adding the bibliography to the document
document.setBibliography(biblio);

// Adding a citation
document.addRowContent("According to " + document.cite("smith2023") + ",
the theory is valid.");
```

Manual Creation of Bibliography Entries

This approach allows you to create references programmatically:

```
// Creating an empty bibliography
Bibliography biblio;
biblio.setStyle(BibStyle::IEEE);

// Creating an article entry
BibEntry articleEntry("smith2023", BibEntry::EntryType::ARTICLE);
articleEntry.addField("author", "John Smith");
articleEntry.addField("title", "Introduction to LaTeX Programming");
articleEntry.addField("journal", "Journal of Document Engineering");
articleEntry.addField("year", "2023");
articleEntry.addField("volume", "42");
articleEntry.addField("number", "1");
articleEntry.addField("pages", "123--456");

// Adding the entry to the bibliography
biblio.addEntry(articleEntry);

// Creating a book entry
BibEntry bookEntry("johnson2022", BibEntry::EntryType::BOOK);
bookEntry.addField("author", "Mark Johnson");
bookEntry.addField("title", "Advanced Document Engineering");
bookEntry.addField("publisher", "Technical Publishing House");
bookEntry.addField("year", "2022");
bookEntry.addField("address", "New York");

// Adding the entry to the bibliography
biblio.addEntry(bookEntry);

// Generating the .bib file
biblio.generateBibFile("output");

// Using the bibliography in the document
document.setBibliography(biblio);

// Adding citations
document.addRowContent("According to " + document.cite("smith2023") + ",
the theory is valid.");
```

```
document.addRowContent("For more details, see " +  
document.cite("johnson2022") + ".");
```

Bibliography Styles

LatexGenC++ supports several common bibliography styles:

- `BibStyle::PLAIN`: Plain style
- `BibStyle::ALPHA`: Alphanumeric style
- `BibStyle::ABBRV`: Abbreviated style
- `BibStyle::IEEE`: IEEE style
- `BibStyle::ACM`: ACM style
- `BibStyle::APA`: APA style
- `BibStyle::CHICAGO`: Chicago style

You can also define a custom style:

```
biblio.setCustomStyle("custom-style-name");
```

Citations

Several citation methods are available:

```
// Standard citation  
document.addRowContent("See " + document.cite("smith2023") + ".");  
  
// Author citation  
document.addRowContent("As indicated in " +  
document.citeAuthor("smith2023") + ".");  
  
// Year citation  
document.addRowContent("This theory was developed in " +  
document.citeYear("smith2023") + ".");  
  
// Citation with multiple references  
document.addRowContent("See " + document.cite({"smith2023", "johnson2022"})  
+ ".");
```

Index

LatexGenC++ allows you to create indexes to facilitate navigation in documents.

```
// Enabling the index  
document.includeIndex(true);  
  
// Adding index entries in the content
```

```
section.addContent("This is an example of indexing. \\index{Indexing}");

// Entry with sub-entry
section.addContent("LaTeX is powerful. \\index{LaTeX!Power}");

// Entry with formatting
section.addContent("Index formatting. \\index{Formatting|textbf}");

// Entry with cross-reference
section.addContent("Cross-reference. \\index{Reference|see{Cross-
reference}}");
```

To compile the document with an index, run the following commands:

```
pdflatex document.tex
makeindex document.idx
pdflatex document.tex
```

Multilingual Support

LatexGenC++ supports 11 different languages:

- `Language::ENGLISH`: English
- `Language::FRENCH`: French
- `Language::GERMAN`: German
- `Language::SPANISH`: Spanish
- `Language::ITALIAN`: Italian
- `Language::PORTUGUESE`: Portuguese
- `Language::DUTCH`: Dutch
- `Language::RUSSIAN`: Russian
- `Language::JAPANESE`: Japanese
- `Language::CHINESE`: Chinese
- `Language::ARABIC`: Arabic

Specify the language when creating the document:

```
// Creating a document in French
Article article("Title", "Author", "Date", Language::FRENCH);
```

Advanced Customization

Document Templates

Templates allow you to apply a consistent style to multiple documents:

```
// Creating a template
DocumentTemplate academicTemplate("Academic");
academicTemplate.setGeometry("margin=2.5cm");
academicTemplate.setHeaderFooterStyle("fancy");
academicTemplate.setHeader("", "\\thetitle", "\\thepage");
academicTemplate.setFooter("\\theauthor", "", "\\today");
academicTemplate.addPackage("microtype");

// Applying the template to the document
academicTemplate.applyTo(document);
```

Packages and Preamble

You can customize the LaTeX preamble:

```
// Adding packages
document.addPackage("listings");
document.addPackage("xcolor");
document.addPackage("graphicx");

// Adding configuration in the preamble
document.addInPreamble("\\lstset{\n"
    "    basicstyle=\\small\\ttfamily,\n"
    "    keywordstyle=\\color{blue}\\bfseries,\n"
    "    commentstyle=\\color{green!60!black}\\itshape\n"
    "}");
```

Complete Examples

Complete examples are available in the [examples/](#) directory:

- [article_example.cpp](#): Example of a scientific article
- [report_example.cpp](#): Example of a technical report
- [book_example.cpp](#): Example of a book
- [presentation_example.cpp](#): Example of a Beamer presentation
- [index_example.cpp](#): Example of index usage
- [multilingual_example.cpp](#): Example of a multilingual document

API Reference

For detailed API documentation, see the header file [include/latexgen.h](#).

Troubleshooting

LaTeX Compilation Issues

If you encounter problems when compiling the generated LaTeX documents:

1. Check that LaTeX is properly installed on your system
2. Make sure all necessary packages are installed
3. Check the LaTeX log file for detailed information about errors

Character Encoding

For documents with special or non-ASCII characters:

```
// Adding support for UTF-8 encoding
document.addPackage("inputenc", "utf8");
document.addPackage("fontenc", "T1");
```

Figure Issues

If figures do not display correctly:

1. Check that the path to the images is correct
2. Make sure the image format is supported by LaTeX (prefer PDF, PNG, or JPG)
3. Add the `graphicx` package by including `document.addPackage("graphicx");` in your code

Bibliography Compilation Issues

If you encounter errors when compiling with bibliography:

1. Make sure to run `pdflatex`, then `bibtex`, then `pdflatex` twice
2. Check that citation keys in the document match the keys in the .bib file
3. Check the syntax of bibliography entries, particularly braces and quotes

Document Compilation

To compile a LaTeX document generated with bibliography and index:

```
# First compilation
pdflatex document.tex

# Bibliography processing
bibtex document

# Index processing (if used)
makeindex document.idx

# Additional compilations to resolve references
pdflatex document.tex
pdflatex document.tex
```

If you have additional questions or wish to contribute to the development of this library, feel free to consult the project repository or contact the author.