

Отчёт по лабораторной работе №4

Including Graphics

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1 Цель работы

Целью данной лабораторной работы является ознакомление с основами включения графики в документы LaTeX.

The purpose of this lab work is to learn how to include and manipulate graphics in LaTeX documents using the `graphicx` package and related tools.

2 Задание

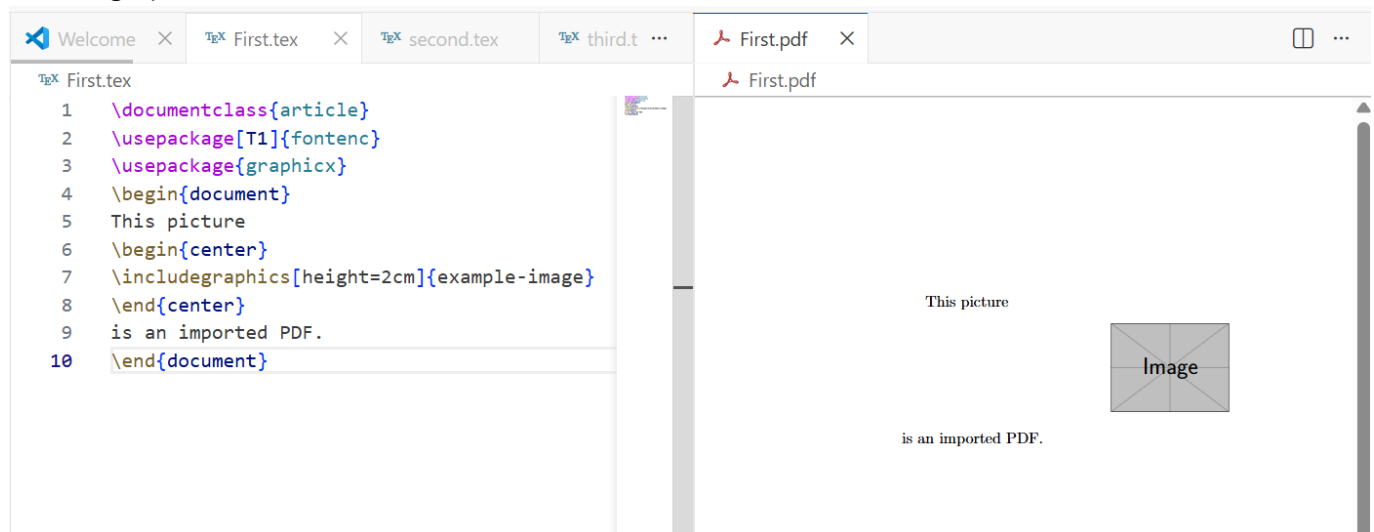
1. Study basic image inclusion with `graphicx` package
2. Learn to modify graphic appearance (size, rotation, scaling)
3. Understand float environments for image placement
4. Practice file naming and organization best practices
5. Learn cross-referencing for figures
6. Explore different float types and positioning options
7. Complete the exercises with practical examples

3 Теоретическое введение

3.1 4 Включение графики / Including Graphics

Для включения внешних изображений в LaTeX используется пакет `graphicx`, который предоставляет команду `\includegraphics`. To include external images in LaTeX, use the `graphicx` package which provides the

`\includegraphics` command.



```

\documentclass{article}
\usepackage[T1]{fontenc}
\usepackage{graphicx}
\begin{document}
This picture
\begin{center}
\includegraphics[height=2cm]{example-image}
\end{center}
is an imported PDF.
\end{document}

```

3.2 4.1 Изменение внешнего вида графики / Altering Graphic Appearance

Команда `\includegraphics` имеет множество опций для управления размером и формой изображений. The `\includegraphics` command has many options to control image size and appearance.

```

\documentclass{article}

\usepackage[T1]{fontenc}

\usepackage{graphicx}

\begin{document}

\begin{center}

\includegraphics[height = 0.5\textheight]{example-image}

\end{center}

Some text

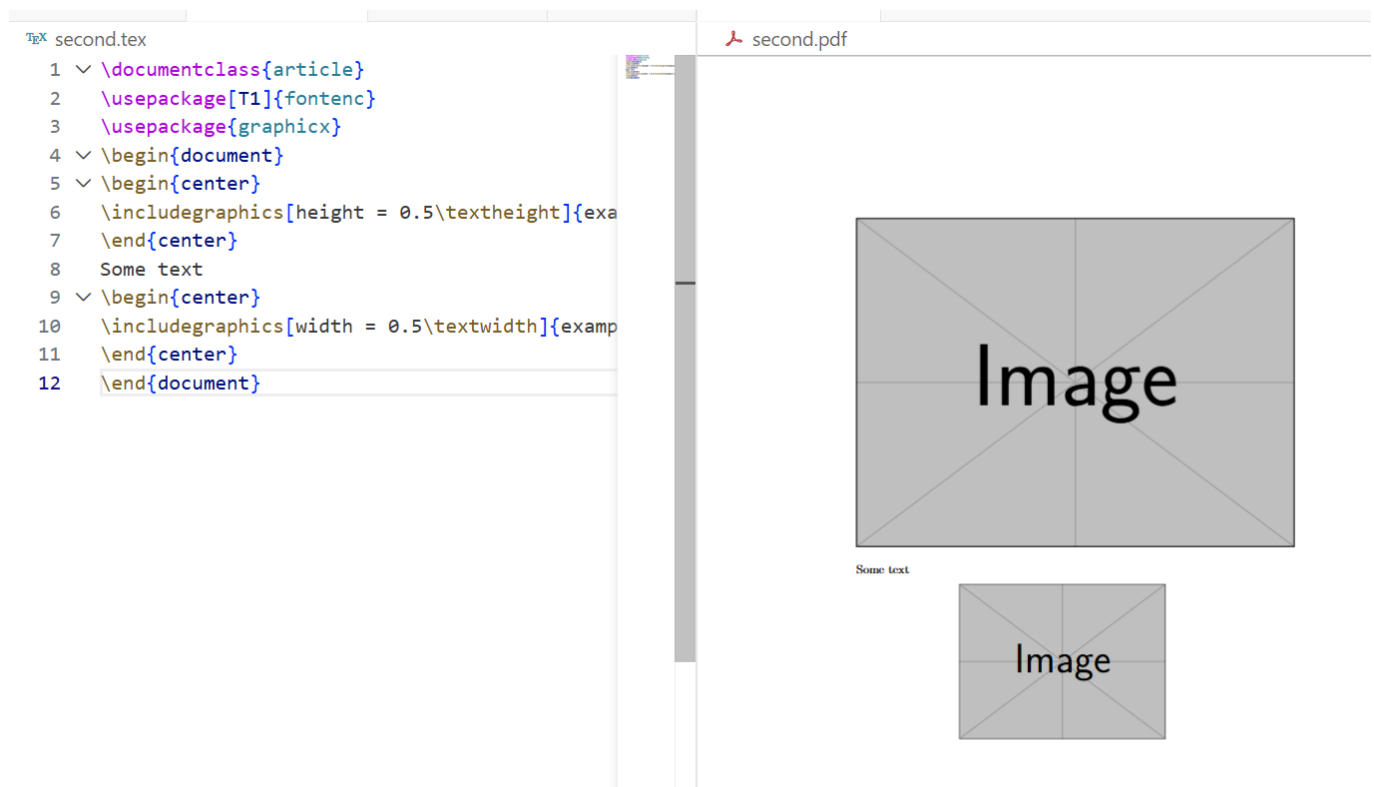
\begin{center}

\includegraphics[width = 0.5\textwidth]{example-image}

```

\end{center}

\end{document}



\documentclass{article}

\usepackage[T1]{fontenc}

\usepackage{graphicx}

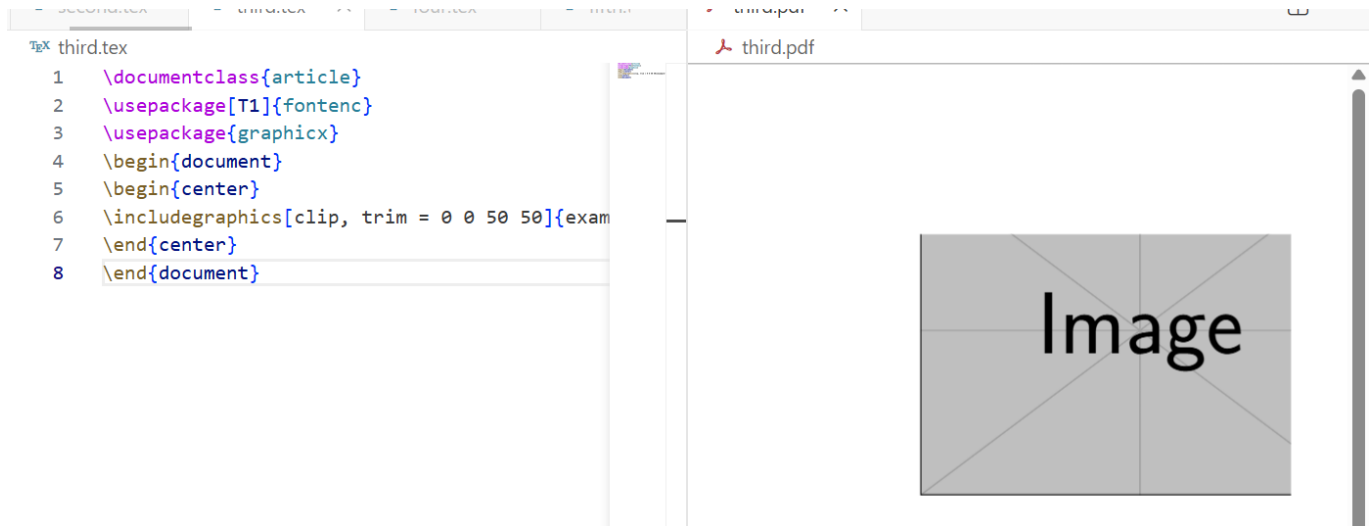
\begin{document}

\begin{center}

\includegraphics[clip, trim = 0 0 50 50]{example-image}

\end{center}

\end{document}



3.3 4.2 Создание плавающих изображений / Making Images Float

Изображения обычно включаются как плавающие объекты (floats) чтобы избежать больших пробелов на странице. Images are typically included as floats to avoid large gaps on the page.

```

\documentclass{article}
\usepackage[T1]{fontenc}
\usepackage{graphicx}
\usepackage{lipsum} % produce dummy text as filler
\begin{document}
\lipsum[1-4] % Just a few filler paragraphs
Test location.
\begin{figure}[ht]
\centering
\includegraphics[width=0.5\textwidth]{example-image-a.png}
\caption{An example image}
\end{figure}
\lipsum[6-10] % Just a few filler paragraphs
\end{document}

```



3.4 4.3 Именованние графических файлов / Naming Graphics Files

Рекомендуется использовать простые имена файлов без пробелов и специальных символов. It's recommended to use simple file names without spaces or special characters.

```
\includegraphics[width=30pt]{pics/myimage.png}
```

3.5 4.4 Хранение графики в поддиректории / Storing Graphics in Subdirectory

Для организации файлов изображения можно хранить в поддиректориях. To organize files, images can be stored in subdirectories.

```
\graphicspath{{figs/}{pics/}}
```

3.6 4.5 Создание графики / Producing Graphics

LaTeX поддерживает различные форматы изображений. Предпочтительно использовать PDF для векторной графики. LaTeX supports various image formats. PDF is preferred for vector graphics.

% создания графики с TikZ

```

\documentclass{article}
\usepackage{tikz}
\begin{document}
\begin{tikzpicture}
\draw (0,0) circle (1cm);

```

```
\draw (-1,0) -- (1,0);  
\end{tikzpicture}  
\end{document}
```

3.7 4.6 Размещение плавающих объектов / Placing Floats

Пакет float предоставляет опцию H для точного размещения плавающих объектов. The float package provides the H option for precise float placement.

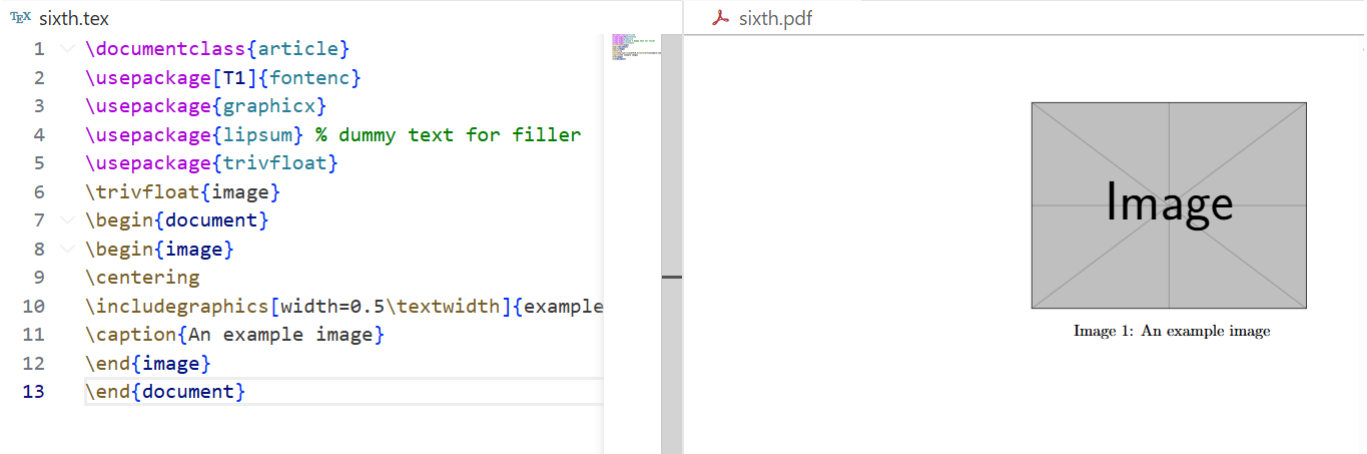
```
\documentclass{article}  
  
\usepackage[T1]{fontenc}  
  
\usepackage{graphicx}  
  
\usepackage{lipsum} % dummy text for filler  
  
\usepackage{float}  
  
\begin{document}  
  
\lipsum[1-7]  
  
\begin{figure}[H]  
  
\centering  
  
\includegraphics[width=0.5\textwidth]{example-image}  
  
\caption{An example image}  
  
\end{figure}  
  
\lipsum[8-15]  
  
\end{document}
```



3.8 4.7 Другие типы плавающих объектов / Other Types of Float

Пакет trivfloat позволяет создавать новые типы плавающих сред. The trivfloat package allows creating new types of float environments.

```
\documentclass{article}
\usepackage[T1]{fontenc}
\usepackage{graphicx}
\usepackage{lipsum} % dummy text for filler
\usepackage{trivfloat}
\trivfloat{image}
\begin{document}
\begin{image}
\centering
\includegraphics[width=0.5\textwidth]{example-image}
\caption{An example image}
\end{image}
\end{document}
```



3.9 4.8 Перекрёстные ссылки / Cross-referencing

Механизм `\label` и `\ref` позволяет создавать ссылки на пронумерованные элементы. The `\label` and `\ref` mechanism allows creating references to numbered elements.

```

\documentclass{article}
\usepackage[T1]{fontenc}
\begin{document}
Hey world!
This is a first document.
\section{Title of the first section}
Text of material for the first section.
\subsection{Subsection of the first section}
\label{subsec:labelone}
Text of material for the first subsection.
\begin{equation}
e^{i\pi} + 1 = 0
\label{eq:labeltwo}
\end{equation}
In subsection~\ref{subsec:labelone} is
equation~\ref{eq:labeltwo}.
\end{document}

```


 seveth.tex

```

1  \documentclass{article}
2  \usepackage[T1]{fontenc}
3  \begin{document}
4    Hey world!
5    This is a first document.
6  \section{Title of the first section}
7    Text of material for the first section.
8  \subsection{Subsection of the first section}
9    \label{subsec:labelone}
10   Text of material for the first subsection.
11  \begin{equation}
12    e^{i\pi} + 1 = 0
13    \label{eq:labeltwo}
14  \end{equation}
15   In subsection~\ref{subsec:labelone} is
16   equation~\ref{eq:labeltwo}.
17  \end{document}

```

 seveth.pdf

Hey world! This is a first document.

1 Title of the first section

Text of material for the first section.

1.1 Subsection of the first section

Text of material for the first subsection.

$$e^{i\pi} + 1 = 0 \quad (1)$$

In subsection ?? is equation ??.

 eighth.tex

```

1  \documentclass{article}
2  \usepackage[T1]{fontenc}
3  \usepackage[hidelinks]{hyperref}
4  \begin{document}
5  \section{Introduction}
6  Some exciting text with a reference~\ref{sec:
7  \section{Next thing}
8  \label{sec:next}
9  More text here.
10 \end{document}

```

 eighth.pdf

1 Introduction

Some exciting text with a reference ??.

2 Next thing

More text here.

`\documentclass{article}`

`\usepackage[T1]{fontenc}`

`\usepackage[hidelinks]{hyperref}`

`\begin{document}`

`\section{Introduction}`

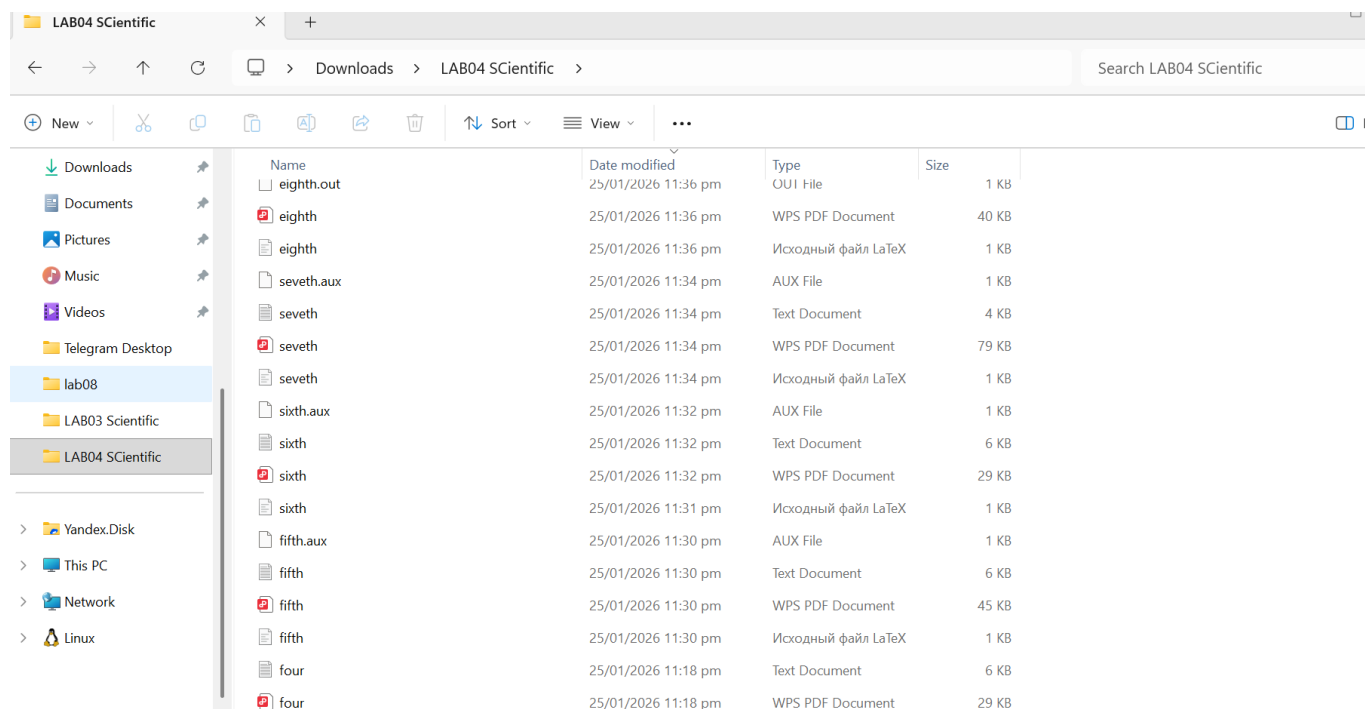
Some exciting text with a reference~\ref{sec:next}.

`\section{Next thing}`

`\label{sec:next}`

More text here.

`\end{document}`



4 Выполнение лабораторной работы

4.1 4.10 Упражнения / Exercises

4.1.1 Упражнение 1: Включение собственного изображения / Including Your Own Image

```
\documentclass{article}
```

```
\usepackage{graphicx}
```

```
\begin{document}
```

```
\begin{figure}[ht]
```

```
\centering
```

```
% \includegraphics[width=0.7\textwidth]{my-photo.jpg}
```

```
\caption{My Photo from LAB04 Folder}
```

```
\label{fig:photo1}
```

```
\end{figure}
```

```
\end{document}
```

TeX nineth.tex > { } Figure: My Photo from LAB04 Folder

```

1  \documentclass{article}
2  \usepackage{graphicx}
3
4  \begin{document}
5  \begin{figure}[ht]
6      \centering
7      % \includegraphics[width=0.7\textwidth]{my-photo.jpg}
8      \caption{My Photo from LAB04 Folder}
9      \label{fig:photo1}
10 \end{figure}
11
12 \end{document}

```

nineth.pdf




Figure 1: My Photo from LAB04 Folder

4.1.2 Упражнение 2: Исследование опций размера и поворота / Exploring Size and Rotation Options

\documentclass{article}

\usepackage{graphicx}

\begin{document}

\includegraphics[height=3cm]{my-photo.jpg}

\includegraphics[width=0.3\textwidth]{my-photo.jpg}

\includegraphics[scale=0.5]{my-photo.jpg}

\includegraphics[angle=45, width=0.2\textwidth]{my-photo.jpg}

\end{document}

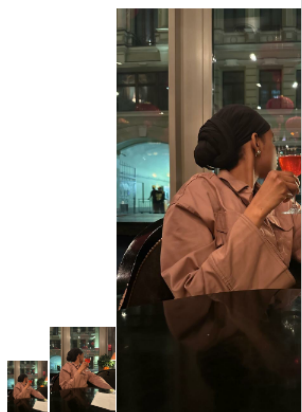

TeX tenth.tex

```

1  \documentclass{article}
2  \usepackage{graphicx}
3
4  \begin{document}
5  \includegraphics[height=3cm]{my-photo.jpg}
6  \includegraphics[width=0.3\textwidth]{my-photo.jpg}
7  \includegraphics[scale=0.5]{my-photo.jpg}
8  \includegraphics[angle=45, width=0.2\textwidth]{my-photo.jpg}
9  \end{document}

```

tenth.pdf

4.1.3 Упражнение 3: Сравнение textwidth и linewidth / Comparing textwidth and linewidth

```
\documentclass[twocolumn]{article}

\usepackage[utf8]{inputenc}

\usepackage[T2A]{fontenc}

\usepackage{graphicx}

\usepackage{lipsum}

\begin{document}

\lipsum[1]

\begin{figure}[ht]

\centering

\includegraphics[width=0.8\linewidth]{my-photo.jpg}

\caption{С использованием \textbackslash linewidth}

\end{figure}

\begin{figure}[ht]

\centering

\includegraphics[width=0.5\textwidth]{my-photo.jpg}

\caption{С использованием \textbackslash textwidth (50\%)}

\end{figure}

\lipsum[2-5]

\end{document}
```

```

elev.tex > {} Figure: С использованием \textbackslash linewidth
1 \documentclass[twocolumn]{article}
2 \usepackage[utf8]{inputenc}
3 \usepackage[T2A]{fontenc}
4 \usepackage{graphicx}
5 \usepackage{lipsum}
6
7 \begin{document}
8 \lipsum[1]
9 \begin{figure}[ht]
10 \centering
11 \includegraphics[width=0.8\linewidth]{my-
12 \caption{С использованием \textbackslash
13 \end{figure}
14 \begin{figure}[ht]
15 \centering
16 \includegraphics[width=0.5\textwidth]{my-
17 \caption{С использованием \textbackslash
18 \end{figure}
19 \lipsum[2-5]
20 \end{document}

```

elev.pdf

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero, nuncummy eget, consectetur id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem. Nulla et lectus vestibulum urna fringilla ultrices. Phasellus eu tellus sit amet tortor gravida placerat. Integer sapien est, iaculis in, pretium quis, viverra ac, nunc. Praesent eget sem vel leo ultrices bibendum. Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum. Nam dui ligula, fringilla a, euismod sodales,



Figure 1: С использованием \linewidth

sollicitudin vel, wisi. Morbi auctor lorem non justo. Nam lacus libero, pretium at, lobortis vitae, ultricies et, tellus. Donec aliquet, tortor sed accumsan bi

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero, nuncummy eget, consectetur id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem. Nulla et lectus vestibulum urna fringilla ultrices. Phasellus eu tellus sit amet tortor gravida placerat. Integer sapien est, iaculis in, pretium quis, viverra ac, nunc. Praesent eget sem vel leo ultrices bibendum. Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum. Nam dui ligula, fringilla a, euismod sodales,



Figure 2: С использованием \textwidth (50%)

bendum, erat, ligula aliquet magna, vitae ornare odio metus a mi. Morbi ac orci et nisl hendrerit mollis. Suspendisse ut massa. Cras nec ante. Pellentesque a nulla. Cum sociis natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus. Aliquam tincidunt urna. Nulla ullamcorper vestibulum turpis. Pellentesque cursus luctus mauris.

Nulla malesuada pellentesque elit. Donec felis erat, congue non, volutpat at, tincidunt tristique, libero. Vivamus viverra fermentum felis. Donec nuncummy pellentesque ante. Phasellus adipiscing semper elit. Proin fermentum massa ac quam. Sed diam turpis, molestie vitae, placerat a, molestie nec, leo. Maecenas lacinia. Nam ipsum ligula, eleifend at, accumsan nec, suscipit a, ipsum. Morbi blandit ligula fengiat magna. Nunc eleifend consequat lorem. Sed lacinia

4.1.4 Упражнение 4: Размещение плавающих объектов с разными спецификаторами / Float Placement with Different Specifiers

```
\documentclass{article}
```

```
\usepackage[utf8]{inputenc}
```

```
\usepackage[T2A]{fontenc}
```

```
\usepackage{graphicx}
```

```
\usepackage{lipsum}
```

```
\begin{document}
```

```
\lipsum[1-2]
```

```
\begin{figure}[h]
```

```
\centering
```

```
\includegraphics[width=0.4\textwidth]{my-photo.jpg}
```

```
\caption{Опция h (здесь)}
```

```
\end{figure}
```

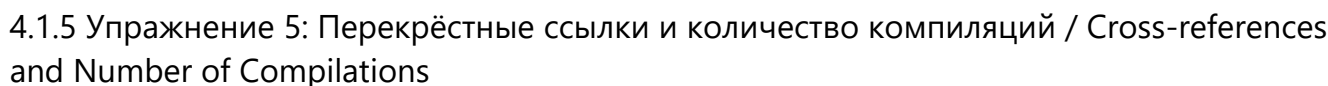
```
\lipsum[3]
```

```
\begin{figure}[t]
```

```
\centering
```

13 / 19

\end{document}



```
\usepackage{lipsum}
```

```
\usepackage{float}

\usepackage{amsmath}

\usepackage[colorlinks]{hyperref}

\begin{document}

\section*{Exercise 5: Cross-references and Number of Compilations}

\subsection*{Useful document}

\subsubsection*{Section (Introduction)}

\label{sec:intro}

In section~\ref{sec:intro}, we present...

\subsubsection*{Subsection (first subsection)}

\label{sub:first}

As seen in subsection~\ref{sub:first}...

\begin{enumerate}

\item First point

\item Second point \label{item:second}

\item Reference to point~\ref{item:second}

\end{enumerate}

% \begin{figure}[ht]

% \centering

% \includegraphics[width=0.5\textwidth]{my-photo.jpg}

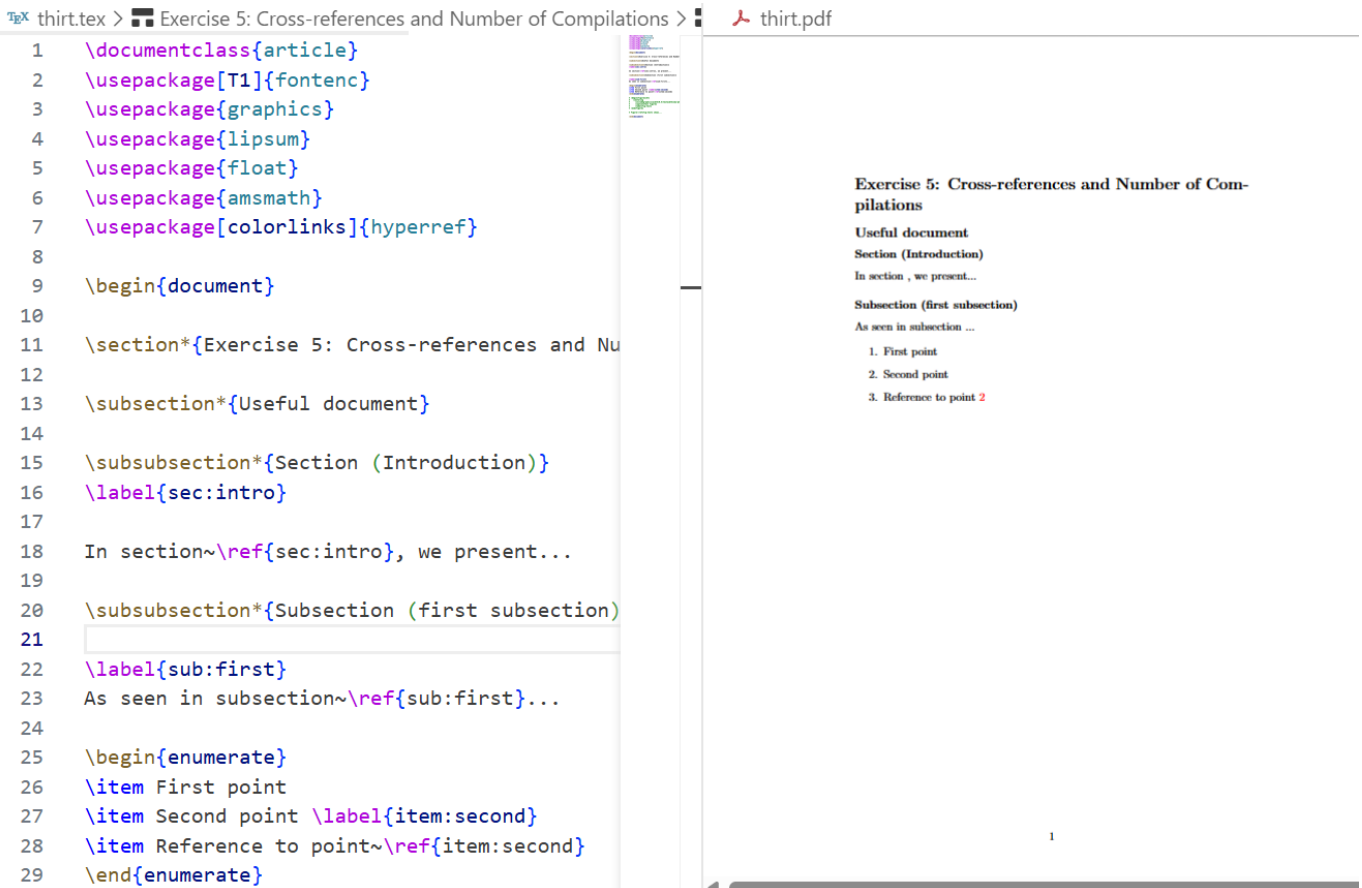
% \caption{Test figure}

% \label{fig:test}

% \end{figure}

% Figure~\ref{fig:test} shows...

\end{document}
```



4.1.6 Упражнение 6: Размещение label до/после caption / Placing label Before/After caption

```

\documentclass{article}

\usepackage[utf8]{inputenc}

\usepackage[T2A]{fontenc}

\usepackage{graphicx}

\begin{document}

\begin{figure}[ht]

\centering

\includegraphics[width=0.4\textwidth]{example-image-a}

\label{fig:before}

\caption{Рисунок с label до caption}

\end{figure}

\begin{figure}[ht]

\centering

\includegraphics[width=0.4\textwidth]{my-photo.jpg}

```


`\caption{Рисунок с label после caption}`

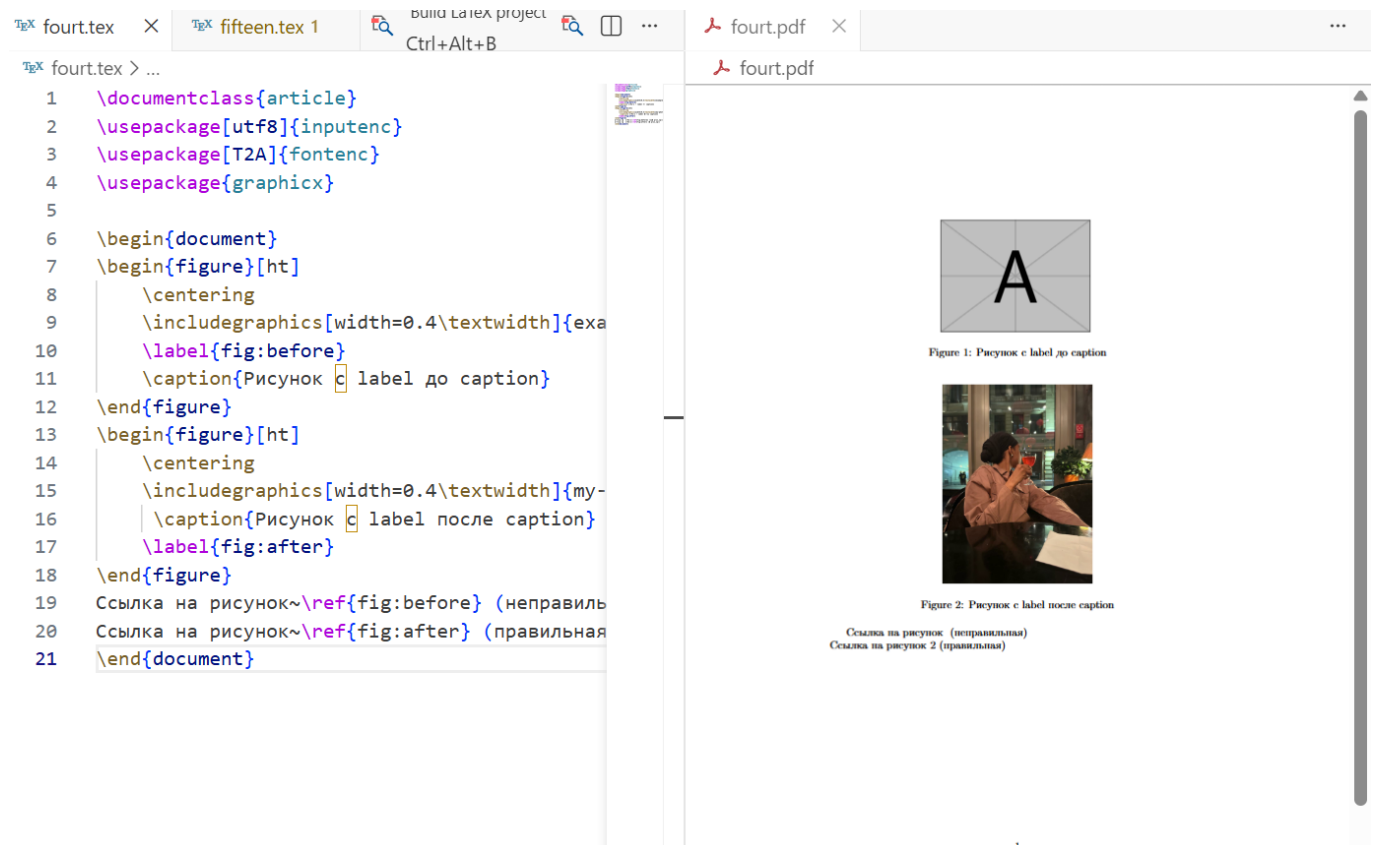
`\label{fig:after}`

`\end{figure}`

Ссылка на рисунок~`\ref{fig:before}` (неправильная)\\

Ссылка на рисунок~`\ref{fig:after}` (правильная)

`\end{document}`



4.1.7 Упражнение 7: label после `\end{equation}` / label After `\end{equation}`

`\documentclass{article}`

`\usepackage[T1]{fontenc}`

`\usepackage{graphicx}`

`\usepackage{lipsum}`

`\usepackage{float}`

`\usepackage{amsmath}`

`\usepackage{hyperref}`

`\title{Exercise 7: \textbackslash label After \textbackslash end{\equation\}}`

`\author{}`

`\date{}`

`\begin{document}`

`\maketitle`

`\section*{Exercise 7: \textbackslash label After \textbackslash end\{equation\}}`

`\begin{equation}`

$E = mc^2$

`\end{equation}`

`\label{eqafter} % AFTER end{equation} - INCORRECT`

`\begin{equation}`

$F = ma$

`\label{eqinside} % INSIDE equation - CORRECT`

`\end{equation}`

Reference to equation `\ref{eqafter}` (incorrect)

Reference to equation `\ref{eqinside}` (correct)

`\textbf{Result:}`

`\begin{itemize}`

`\item \textbackslash label after \textbackslash end\{equation\} \rightarrow incorrect reference (usually to previous equation or section)`

`\item \textbackslash label inside the equation environment \rightarrow correct reference to the equation`

`\end{itemize}`

`\end{document}`

TeX

fifteen.tex > Exercise 7: \textbackslash label After \textbackslash end\ec

1 \documentclass{article}

2 \usepackage[T1]{fontenc}

3 \usepackage{graphicx}

4 \usepackage{lipsum}

5 \usepackage{float}

6 \usepackage{amsmath}

7 \usepackage{hyperref}

8

9 \title{Exercise 7: \textbackslash label After \textbackslash end\ec}

10 \author{}

11 \date{}

12

13 \begin{document}

14

15 \maketitle

16

17 \section*{Exercise 7: \textbackslash label After \textbackslash end\ec}

18

19 \begin{equation}

20 E = mc^2

21 \end{equation}

22 \label{eqafter} % AFTER end{equation} - INCORRECT

23

24 \begin{equation}

25 F = ma

26 \label{eqinside} % INSIDE equation - CORRECT

27 \end{equation}

28

29 Reference to equation \ref{eqafter} (incorrect)

fifteen.pdf

Exercise 7: \label After \end{equation}

Exercise 7: \label After \end{equation}

$$E = mc^2 \tag{1}$$

$$F = ma \tag{2}$$

Reference to equation (incorrect)

Reference to equation (correct)

Result:

- \label after \end{equation} -> incorrect reference (usually to previous equation or section)
- \label inside the equation environment -> correct reference to the equation

1

✗ chktex could not be found.

5 Выводы

В ходе лабораторной работы №4 я изучил основы включения и управления графикой в документах LaTeX. Освоил работу с пакетом `graphicx`, научился создавать плавающие объекты, управлять их размещением и создавать перекрёстные ссылки на изображения. Также изучил лучшие практики организации графических файлов и их именования.

In this lab work #4, I learned the fundamentals of including and manipulating graphics in LaTeX documents. I mastered the `graphicx` package, learned to create float objects, control their placement, and create cross-references to images. I also studied best practices for organizing graphic files and naming them.

Список литературы

LaTeX/Математические формулы — Викиучебник. <https://ru.wikibooks.org/wiki/LaTeX/>

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