GEN 280: Technical Reports

Week 3: Writing the Methodology

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Spring 2022

Lecture Outline:

1. Getting started using LaTeX
2. What goes in the procedure section?
3. Language check: what are the rules?
4. Figures and diagrams.

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Getting started using LaTeX

A minimal LaTeX document

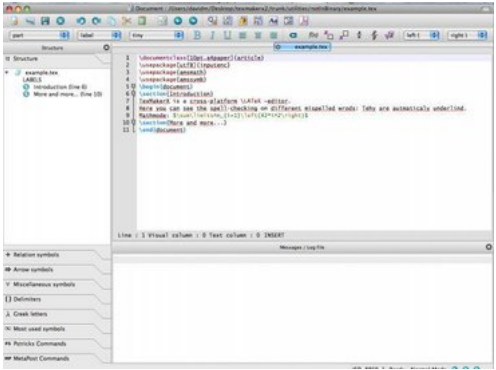
```
\documentclass{article}
\begin{document}
Hello World! % your content goes here...
\end{document}
```

- Commands start with a backslash \.
- Every document starts with a \documentclass command.
- The argument in curly braces {} specifies we are creating an article.
- A percent sign % starts a comment.

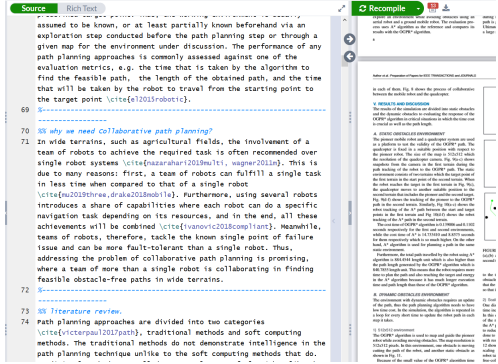
Getting started using LaTeX

Required software

- **Using your PC:**
  - *Compiler:* TeXLive (install first!)
  - *Editor:* TeXStudio



- **Web-based:**
  - *Overleaf*



Getting started using LaTeX

Typesetting text

- Type your text between **begin**{**document**} and **end**{**document**}.
- For the most part, you can just type your text normally.

`Words are separated by one or more spaces.`
 	
`Paragraphs are separated by one or more blank lines.`
	Words are separated by one or more spaces.
	
	Paragraphs are separated by one or more blank lines.

- Space in the source file is collapsed in the output.

`The rain in Spain falls mainly on the plain.`	The rain in Spain falls mainly on the plain.

Getting started using LaTeX

Typesetting text

- Quotation marks: use a backtick ` on the left and an apostrophe ´ on the right.

`Single quotes: `text'.`	Single quotes: ‘text’.
`Double quotes: ``text''.`	Double quotes: “text”.

- Some common characters have special meanings in LaTeX

%	percent sign
#	hash (pound / sharp) sign
&	ampersand
$	dollar sign

- To write them in the output, you have to escape it by preceding it with a backslash.

`\$\%\&\#!`	$%&#!

Getting started using LaTeX

Typesetting mathematics

- The dollar signs $ are use them to mark mathematics in text.

```
% not so good:
Let a and b be distinct positive
integers, and let c = a - b + 1.

% much better:
Let $a$ and $b$ be distinct positive
integers, and let $c = a - b + 1$.
```

Let a and b be distinct positive integers, and let c = a - b + 1.

Let a and b be distinct positive integers, and let $c = a - b + 1$.

- Always use dollar signs in pairs $ $ one to begin the mathematics, and one to end it.
- LaTeX handles spacing automatically; it ignores your spaces.

```
Let $y=mx+b$ be \ldots

Let $y = m x + b$ be \ldots
```

Let $y=mx+b$ be \ldots

Let $y = m x + b$ be \ldots

Getting started using LaTeX

Typesetting mathematics

- Use caret ^ for superscripts and underscore _ for subscripts.

```
$y = c_2 x^2 + c_1 x + c_0$
```

$y = c_2 x^2 + c_1 x + c_0$

- Use curly braces {} to group superscripts and subscripts.

```
$F_n = F_n-1 + F_n-2$      % oops!

$F_n = F_{n-1} + F_{n-2}$ % ok!
```

$F_n = F_n - 1 + F_n - 2$

$F_n = F_{n-1} + F_{n-2}$

- There are commands for Greek letters and common notation.

```
$\mu = A e^{Q/RT}$

$\Omega = \sum_{k=1}^{n} \omega_k$
```

$\mu = A e^{Q/RT}$

$\Omega = \sum_{k=1}^{n} \omega_k$

Getting started using LaTeX

Typesetting mathematics: Displayed Equations

- Equations could be displayed on its own line using \beginequation and \endequation.

```
The roots of a quadratic equation
are given by
\begin{equation}
x = \frac{-b \pm \sqrt{b^2 - 4ac}}
         {2a}
\end{equation}
where $a$, $b$ and $c$ are \ldots
```

The roots of a quadratic equation are given by

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \quad (2)$$

where a, b and c are ...

Be careful: LaTeX mostly ignores your spaces in mathematics, but it can't handle blank lines in equations — don't put blank lines in your mathematics.

Getting started using LaTeX

Environments

- The \begin and \end commands are used to create many different environments.
- The **itemize** and **enumerate** environments generate lists.

```
\begin{itemize} % for bullet points
\item Biscuits
\item Tea
\end{itemize}

\begin{enumerate} % for numbers
\item Biscuits
\item Tea
\end{enumerate}
```

- Biscuits
- Tea

1. Biscuits
2. Tea

Getting started using LaTeX

Packages

- All of the commands and environments we've used so far are built into LaTeX.
- **Packages** are libraries of extra commands and environments.
- There are thousands of freely available packages.
- We have to load each of the packages we want to use with a **usepackage** command in the preamble.
- Example: **amsmath** from the American Mathematical Society.

```
\documentclass{article}
\usepackage{amsmath} % preamble
\begin{document}
% now we can use commands from amsmath here...
\end{document}
```

Getting started using LaTeX

Typesetting mathematics

- Use **equation*** for unnumbered equations.

```
\begin{equation*}
  \Omega = \sum_{k=1}^{n} \omega_k
\end{equation*}
```

$$\Omega = \sum_{k=1}^{n} \omega_k$$

- **amsmath** defines commands for many common mathematical operators.

```
\begin{equation*} % bad!
 min_{x,y} (1-x)^2 + 100(y-x^2)^2
\end{equation*}
\begin{equation*} % good!
\min_{x,y}{(1-x)^2 + 100(y-x^2)^2}
\end{equation*}
```

$$min_{x,y}(1-x)^2+100(y-x^2)^2$$

$$\min_{x,y} (1-x)^2 + 100(y-x^2)^2$$

- You can use **operatorname** for others.

```
\begin{equation*}
\beta_i =
\frac{\operatorname{Cov}(R_i, R_m)}
     {\operatorname{Var}(R_m)}
\end{equation*}
```

$$\beta_i = \frac{\operatorname{Cov}(R_i, R_m)}{\operatorname{Var}(R_m)}$$

Getting started using LaTeX

Typesetting mathematics

- Align a sequence of equations at the equals sign with the **align*** environment.

```
\begin{align*}
(x+1)^3 &= (x+1)(x+1)(x+1) \\
        &= (x+1)(x^2 + 2x + 1) \\
        &= x^3 + 3x^2 + 3x + 1
\end{align*}
```

- An ampersand & separates the left column (before the =) from the right column (after the =).
- A double \\ starts a new line.

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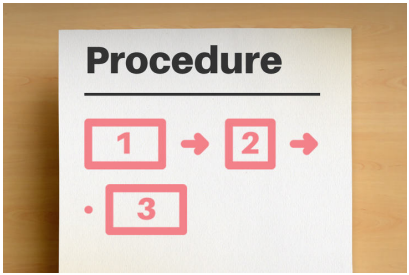
What goes in the procedure section?

Information in the procedure section can be classified in one of two categories:

1. information about the equipment, technique, algorithm, etc. (**Understand**)
2. information about the experimental procedure. (**Replicate**)



What goes in the procedure section?

When it comes to describing your equipment, you may find it useful to consider the different types of equipment you used:

Measurement equipment

The equipment you used to record your results.

Facilitation equipment

The equipment which allows 'changes' to be made to the system.

Some advices:

- Start your report by writing the method since it is fresh in your mind.
- Write extremely clearly, with generally not more than twosteps described in one sentence.

What goes in the procedure section?

Which of the following is good in procedure?

How much detail should you use when describing this piece of equipment?

- The temperature was measured using a thermometer
- The temperature was measured using a thermocouple
- The temperature was measured using a type-K thermocouple
- The temperature was measured using a type-K thermocouple which has a temperature range from -270 to 1200°C and an accuracy of $\pm$ 1°C

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Language check: what are the rules?

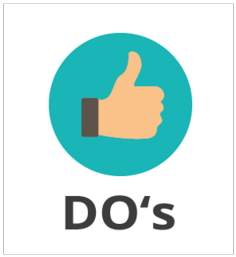
Use of Passive Voice.

Use passive voice

The reader wants to focus on the experimental (or numerical) method, so the writer (i.e. you!) has to become invisible. This means using the passive voice.

Language check: what are the rules?

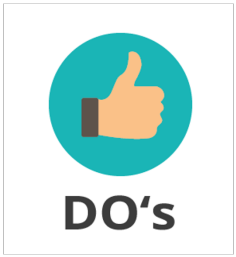
Language do's and don'ts.



Language check: what are the rules?

Language do's and don'ts.

- Remember **who the reader is**.



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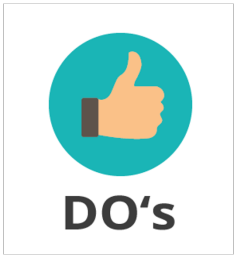
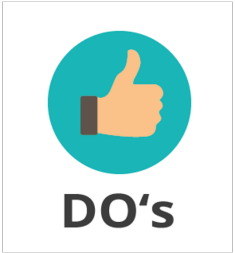


- Remember **who the reader is**.
- Write the methods section in the **same order** that you carried out the experiment.

Language check: what are the rules?

Language do's and don'ts.



- Remember **who the reader is**.
- Write the methods section in the **same order** that you carried out the experiment.
- Write the methods section in **paragraphs** and connect your sentences.

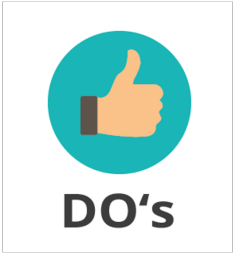
Language check: what are the rules?

Language do's and don'ts.

- Remember **who the reader is**.
- Write the methods section in the **same order** that you carried out the experiment.
- Write the methods section in **paragraphs** and connect your sentences.
- Use the **Passive** Voice.

Language check: what are the rules?

Language do's and don'ts.



- Remember **who the reader is**.
- Write the methods section in the **same order** that you carried out the experiment.
- Write the methods section in **paragraphs** and connect your sentences.
- Use the **Passive** Voice.
- Use **sequence words** to explain the order of what happened, e.g "First, Following this, . . . ".

Language check: what are the rules?

Language do's and don'ts.

- Remember **who the reader is**.
- Write the methods section in the **same order** that you carried out the experiment.
- Write the methods section in **paragraphs** and connect your sentences.
- Use the **Passive** Voice.
- Use **sequence words** to explain the order of what happened, e.g "First, Following this, . . . ".
- Use words and phrases like **'to', 'so as to' and 'in order to'** to explain the purpose of a stage.

Language check: what are the rules?

Language do's and don'ts.

- Remember **who the reader is**.
- Write the methods section in the **same order** that you carried out the experiment.
- Write the methods section in **paragraphs** and connect your sentences.
- Use the **Passive** Voice.
- Use **sequence words** to explain the order of what happened, e.g "First, Following this, . . . ".
- Use words and phrases like **'to', 'so as to' and 'in order to'** to explain the purpose of a stage.
- Use **full forms** rather than contractions e.g. 'do not', 'will not', 'cannot'.

Language check: what are the rules?

Language do's and don'ts.

Language check: what are the rules?

Language do's and don'ts.

- Copy and paste the instructions from manuals.

Language check: what are the rules?

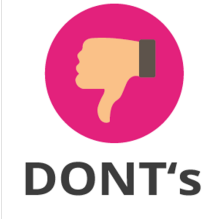
Language do's and don'ts.

- Copy and paste the instructions from manuals.
- Just list your actions.

Language check: what are the rules?

Language do's and don'ts.

- Copy and paste the instructions from manuals.
- Just list your actions.
- Use 'I' or 'We.'



Language check: what are the rules?

Language do's and don'ts.

- Copy and paste the instructions from manuals.
- Just list your actions.
- Use 'I' or 'We.'
- Use vague words like 'stuff', 'things'.

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Figures and diagrams.

Where should you use figures?

- At the **start of the report**, it may be appropriate to include a **photo** to characterise the background or context of the topics.
- When **discussing a concept**, labelled **schematic diagrams** are much better for conveying key points.
- Whatever type of figure you are including in the report, make sure to **be consistent** with the style you use to present them.

Figures and diagrams.

Where should you use figures?

When adding a figure, there are three simple things you need to check:

- Every figure is numbered consistently.
- The figure is referred to in the text (preferably before the figure is shown).
- The figure has a caption that describes what it is.

achieved with $\mathbf{K_p} = \text{Diag}(100, 5 \times 10^{-3}, 1000)$ and $\mathbf{K_p} = \text{Diag}(\mathbf{10}, \mathbf{1000}, \mathbf{100})$. As depicted in Figure 8, the vine robot with the proposed control scheme has proved reasonable tracking as was expected in the three coordinates. However, the robot loses tracking when its current length is higher than the desired one as noted. This, in fact, is due to the irreversible growth process ex-

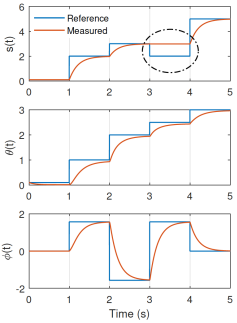

Fig. 8 Dynamic response for s, θ and ϕ with multiple desired lengths. The robot loses tracking when the desired length is lower than its current length.

Questions?

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