

# Solution to Homework Assignment I/II

First Name Last Name, Student ID

## I. INTRODUCTION

Use this  $\LaTeX$  template to document your homework assignment solution. The template is based on the IEEE journal format standard, which is widespread for scientific papers in the engineering community. If you are not an advanced  $\LaTeX$  user, do not be afraid since all relevant commands needed to insert your solutions in this document will be briefly explained next.

### A. Equations

You can insert equations with numbering

$$a^2 + b^2 = c^2 \tag{1}$$

or without

$$c = \pm\sqrt{a^2 + b^2}.$$

Multi line equations are also possible

$$\begin{aligned} \frac{d}{dt} \mathbf{x}(t) &= \mathbf{A}\mathbf{x}(t) + \mathbf{B}\mathbf{u}(t), \\ \mathbf{y}(t) &= \mathbf{C}\mathbf{x}(t) + \mathbf{D}\mathbf{u}(t). \end{aligned} \tag{2}$$

Here, vectors and matrices have been depicted in bold font using the `\bm{}` command in math mode. Although many symbols in mathematical formulae are depicted in italic font, on the contrary, some require upright font such as

- mathematical operators (e.g. the differential  $d/dt$ ),
- unit symbols such as ampere, volt, seconds, newton, etc. (e.g.,  $1\text{ N} = 1\text{ kg m s}^{-2}$ ),
- function names like `cos`, `sin` and
- descriptive sub and superscripts (e.g.  $\mathbf{x}_{\text{start}}$ ).

In this context, the `\mathrm{}` command can be very helpful. Equations can be also inserted within the text lines (e.g.,  $x = y$ ) using the dollar sign notation  $\$x=y\$$ . You can also reference equations, e.g. (1), by using the `\eqref{}` command which automatically adjusts the equation reference number in case the equation order is changed at a later date. Please also note that equations are considered regular parts of a grammatically correct English sentence, i.e., they require the usual punctuation with commas, full stops, etc.

Additional resources on mathematical representations:

- List of most common math commands and symbols: <https://en.wikibooks.org/wiki/LaTeX/Mathematics>
- Typographical conventions: [https://en.wikipedia.org/wiki/Typographical\\_conventions\\_in\\_mathematical\\_formulae](https://en.wikipedia.org/wiki/Typographical_conventions_in_mathematical_formulae)

### B. Figures

Figures and plots can be inserted using the `\includegraphics[]{}` command which is normally encapsulated within a floating area defined by

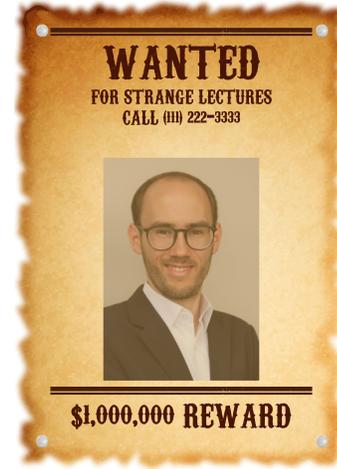


Fig. 1. Who knows that guy?

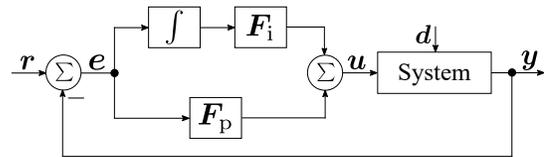


Fig. 2. Example of a block diagram (vector graphic)

`\begin{figure}\end{figure}`. Likewise equations, figures can be labeled and referenced automatically within the document, cf. Fig. 1.

In engineering documents many figures are representing technical information such as block diagrams (cf. Fig. 2) or results from simulations (cf. Fig. 3). In such cases it is highly recommended to use vector graphic formats which are normally embedded within pdf files. Compared to pixel-based graphics the resulting figure quality is crystal clear and requires (in most cases) much less data space.

Additional resources on figures:

- Some general information on importing graphics in  $\LaTeX$ : [https://en.wikibooks.org/wiki/LaTeX/Importing\\_Graphics](https://en.wikibooks.org/wiki/LaTeX/Importing_Graphics)
- Exporting figures from Matlab with `print()`: <https://www.mathworks.com/help/matlab/ref/print.html>
- External toolbox for Matlab figure exporting: [https://github.com/altmany/export\\_fig](https://github.com/altmany/export_fig)
- For drawing own vector graphics (e.g. for block diagrams) the open-source software Inkscape (<https://inkscape.org/>) is highly recommended.
- With TikZ (<https://texample.net/tikz/examples/>) exists also an alternative to "draw" figures within  $\LaTeX$ . But it requires some time to get used to command line drawing.

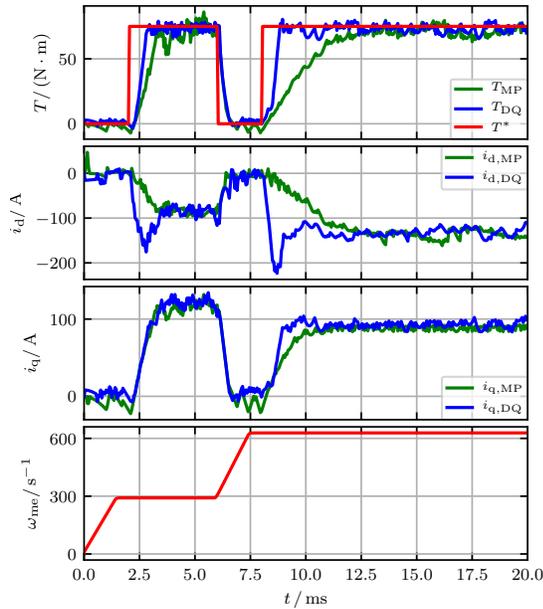


Fig. 3. Example of a simulation result (also vector graphic)

C. Tables

Tables are also encapsulated in floats called via `\begin{table}\end{table}` by default. An example can be found in Tab. I. There it should be noted that vertical lines are avoided – which is a very good rule of thumb to create nice, easy readable tables. Additional resources:

- Background information on table types and definitions: <https://de.overleaf.com/learn/latex/tables>
- Particular nice tables with `booktabs`: <https://nhigham.com/2019/11/19/better-latex-tables-with-booktabs/>

TABLE I  
FANCY TABLE

Models	precision	$\ \mathbf{x}\ _2$	$\ \mathbf{x}\ _1$	$\ \mathbf{x}\ _\infty$
model 1	0.67	0.8	0.729	0.75
model 2	0.8	0.9	0.847	0.85

D. Further specifications and hints

- In most scientific papers American English is used. Stick to this convention for your solution.
- Use concise, to the point sentences that guide the reader through the text. Most scientific publishers only accept papers of certain maximum length, so text space is precious. Also, nobody has time to read lengthy documents.
- Avoid unobjective, emotional language – remain neutral in your evaluation and factual in your choice of words.
- Use Google (or another search engine of your choice):  $\LaTeX$  is the default typesetting framework for scientific texts. If you have any question on how to do something within  $\LaTeX$  or getting some compilation errors or searching for a beginners tutorial: you will find it with a simple internet research in no time.

- You can write your solution in your free-of-charge Overleaf account or you can download the template and install a local  $\LaTeX$  distribution (cf. <https://www.latex-project.org/get/>) on your personal machine. In either case, just submit the final pdf as your homework solution and not the source files.
- Be independent and get to the bottom of things. When starting to work in industry or academia your boss wants to see a solution solver and not problem deliverer (which includes writing nice texts in  $\LaTeX$ ).

II. TASK 1

Your solution goes here

III. TASK 2

Your solution goes here

IV. TASK ...

Your solution goes here