**Embedded exercise work**

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# Introduction

This exercise work is to make motion detection system with two Arduinos. We have Arduino uno responsible for displaying information for user and Arduino Mega responsible for sensors and keeping states.

# Styles

The chapter headings are presented in Heading 1 style and numbered accordingly. The list of references and appendices are not numbered. There is an empty line between the text paragraphs. Pages are numbered right or in the middle at the top of the page. There should be more than one sentence in a paragraph, and more than one paragraph in a chapter or a subsection. Both margins of the paragraph are justified. For instance the margins of this document can be applied to a Bachelor’s thesis.

## Equations

Subsections are presented in the second-level (Heading 2) style. There should always be some body text between the headings of different levels.

The sources of all cited equations have to be given. Derivation of the equations is not demonstrated unless specifically required. However, the main steps of the derivation of new equations should be presented. Equations are numbered according to the chapter (1.1)−(4.23) so that the first number denotes the chapter and the second number the equation. In addition to other equation editors, there is a tool available for equations in Word. Variables are given in italics, constants in upright style. For instance, voltage in phase a is written

, (1.1)

where *R*2 is the resistance and *I*a is the current in phase a. Do not refer to equations by number before they are presented in the text. In the body text, equations are placed in brackets (); for instance, Eq. (1.1) gives the voltage as a product of resistance and current.

## Figures and tables

If figures, tables or equations are incorporated in the study, they should also be discussed in the text, preferably in the preceding paragraphs (note the comment above on equation numbers). The numbers of figures and tables are not given in brackets when mentioned in the body text. Otherwise, the same guidelines apply to the numbering of tables and figures as for equations; for instance, Figure 1.1 shows the voltage as a function of time. The figure and table captions should be written in a concise and informative manner so that the figure and caption alone provide adequate information about the topic under study. No frames are added to the figures, and no background colour is used. Figures are centred.



Figure 1.1 Voltage as a function of time. The caption is placed below the figure. No frames or background colour are included. (Font size 10, upright style).

When presenting measurement results, it is not advisable to give all the digits available but the results are rounded to a level relevant to the measurement accuracy, Table 1.1. Units should be indicated both in the figures and in the tables.

Table 1.1 Root-mean-square (rms) values *In* ofcurrent harmonic components, where *n* is the order of the harmonic component. The table title is placed above the table. (Font size 10, upright style.)

|  |  |
| --- | --- |
| *n* | *In* [A] |
| 1 | 10.25 |
| 2 | 0 |
| 3 | 9.11 |
| 4 | 0 |
| 5 | 7.34 |
| 6 | 0 |
| 7 | 5.82 |

The table or figure and the caption are kept together at page breaks. Avoid splitting a table between pages. Do not end a chapter with a figure or a table but write a concluding paragraph or a summary after the illustration.

### Example of third-level headings

A maximum of three numbered heading levels is recommended. You may for instance consider rearranging or regrouping your text or combining subsections under a new heading.

## Referencing

You must always acknowledge the sources you have used when preparing your text. This is done by making exact reference to the source you are referring to or quoting from so that the reader is able to locate and check the original source. Direct quotations are not recommended. Nevertheless, if quotations are integrated into the text, they are enclosed in “quotation marks”. Quotations longer than a few words (e.g. full sentences) are set off as a block quotation and indented as a separate paragraph with single line spacing.

Harvard system (alphabetical, author/date) is recommended. When making reference to an author’s work, the author’s name and date are placed in brackets within the sentence (Nykänen 2002). In Finnish, when the reference applies to a unit larger than a sentence (whole paragraph), the reference is placed after the full stop.

# Conclusions

The conclusions section introduces the key results and contributions of the study. The results are summarised and elevated to a more general level in a concise manner. Thus, by reading the conclusions, the reader is able to get an insight into the key results and outcomes of the work. If some of the results are erroneous, also this should be mentioned regardless of whether the root cause of the error is known or not.

Further, the conclusions section evaluates the achievement of the research objectives, the key contributions of the work and possible topics of further studies.

# References

The sources referred to in the work are listed at the end of the document. The reference list below is compiled according to the Harvard referencing style. Note that there are slight differences between the Finnish and English guidelines. Nevertheless, the list of references should always include all the works referred to in the text (e.g. books, journal articles, web sites, interviews). The sources are listed in an alphabetical order.

Alred, G. J., Brusaw, C. T. & Oliu, W. E. 2006. *Handbook of Technical Writing*. Eighth Edition. New York: St. Martin’s Press.

Barnbaum, C. n.d. *Plagiarism. A Student’s Guide To Recognizing It and Avoiding It.* [Online]. [Accessed 3 August 2014]. Available at

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Chesterman, A. et al. 2001. *Guidelines for Essays, Theses, Assignments, Term papers and Take-home examinations, Proseminar and Seminar papers, Research papers, Pro Gradu theses...* Revised by Bush, L., Nurmi, A. & Keinänen, N. Helsinki: University of Helsinki.

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Hirsjärvi, S., Remes, P., Sajavaara, P. 2009. *Tutki ja kirjoita*. 18th edition. Helsinki: Tammi.

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Ikola, O. 1986. *Nykysuomen käsikirja.* Toinen uudistettu laitos. Espoo: Weilin+Göös.

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Nykänen, O. 2002. *Toimivaa tekstiä. Opas tekniikasta kirjoittaville.* Helsinki: Tekniikan akateemisten liitto TEK.

Perttunen, J. M. 2000. *The Words Between. Lääketieteen ja luonnontieteen englantia*. Fourth Edition. Helsinki: Duodecim.

*Publication Manual of the American Psychological Association* 2000. Fourth Edition. Washington, DC: American Psychological Association.

Quirk, R., Greenbaum, S., Leech, G. & Svartvik, J. 1985. *A comprehensive grammar of the English language*. London: Longman.

*Standardien tekijänoikeus*. [Online]. [Accessed 3 August 2014]. Available at <http://www.sfs.fi/julkaisut_ja_palvelut/tekijanoikeus/>

Tutkimuseettinen neuvottelukunta. *Hyvä tieteellinen käytäntö ja sen loukkausten käsitteleminen.* [Online]. [Accessed 3 August 2014]. Available at

<http://www.tenk.fi/en>

**Examples of conference proceedings and journal papers:**

Cistelecan, M.V., Popescu, M. & Popescu, M. 2007. “Study of the Number of Slots/Pole Combinations for Low Speed Permanent Magnet Synchronous Generators.” In *Conf. Rec. IEEE IEMDC*, Antalya, Turkey. May 3–5. pp. 1616–1620.

Polinder, H., van der Pijl, F. F. A., de Vilder, G-J. & Tavner P. J. 2006. “Comparison of Direct-Drive and Geared Generator Concepts for Wind Turbines.” *IEEE Trans. Energy Convers.*, vol. 21, no, 3, pp. 725–733.

**APPENDICES**

Information that is relevant to the work but does not necessarily have to be found in the body text can be presented in appendices. Appendices may include for instance equations, tables, figures, algorithms, measurement results and datasheets. The title of the appendix is given at the top of the page.

If the number of the appendix is given in the right upper corner, it is indicated by roman numerals (APPENDIX I, APPENDIX II). If the number is given in front of the heading, Arabic numerals are used (Appendix 1. Circuit diagram of the inverter). Appendices are not included in the page numbering of the rest of the document.