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**STYLE GUIDE FOR GRADUATE THESES
AND DISSERTATIONS**

October, 2010

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FOREWORD

This guide is a supplement to the Graduate School manuals for theses and dissertations; it provides a suggested style as described in the "Style Requirements" section of those manuals. (Hereafter, the term "thesis" may be used to refer to both the master's thesis and the PhD dissertation.) The style described herein conforms, with some minor exceptions, to the style prescribed by the American Society of Mechanical Engineers. The student's thesis/dissertation committee may feel that variations in the style described are appropriate; thus, the committee should be consulted before thesis production begins.

The paper, type, format, and other requirements described in the Graduate School manuals must be followed!! This guide only addresses style issues.

Rick J. Couvillion
Chairman, Mechanical Engineering Graduate Studies Committee
October, 2010

STYLE GUIDELINES

First note that the font and font size must be the same throughout the thesis - 10 pt Arial or 12 pt Times New Roman. Boldface and underline may be used for headings and subheadings.

Divisions and Subdivisions of the Thesis

Each major division of the thesis (preface, table of contents, list of tables, list of illustrations, introduction, chapters, references, etc.) begins on a new page. The heading is bold, centered, and all capitals. No ending punctuation is used. The first line of a chapter heading carries the word "**CHAPTER**" followed by the chapter number in Arabic numerals. There is a space between this line and the chapter title and three spaces between the chapter title and the first line of text or first-rank heading. The chapter title is single spaced if more than one line is needed. The arrangement of titles and subdivisions within a chapter and their spacing is explained and shown by the headings immediately following. The style described herein for thesis headings and divisions is used throughout this guide.

First-rank Heading

If there is but one rank of heading within a chapter, subdivisions are boldface, centered, and in initial capitals, with three spaces between it and the last line of text above and one space between it and the text following. See heading for this section immediately above

Second-rank Heading

If there are two ranks of headings, the main rank appears as described in the preceding paragraph, while subdivisions within the main rank are boldface with a space above and one space below, and in initial capitals. The heading begins at the left margin. See heading for this section immediately above.

Third-rank Heading. If there are three ranks of headings, the first two ranks appear as described in the two preceding paragraphs, while the third rank is indented the same as a regular

paragraph, boldface, and in initial capitals. There is one space left above. A period follows this heading, and, after one space, the paragraph begins on the same line.

Fourth-rank Heading. If a fourth-rank heading is needed, it is indented, not bold, underlined, and in initial capitals. There is one space above. A period follows the heading. After one space, the paragraph begins on the same line.

Numerals

In the text material, the number 10 or over is expressed in figures, and numbers under 10 are spelled out (with exceptions as mentioned below). Only Arabic numbers are used. Any number, regardless of size or nature, occurring at the beginning of a sentence must be spelled out. Numbers appearing in a statistical series (e.g., 2, 4, 29, and 48) are expressed in figures; as are date, page, street, and telephone numbers; decimals and percentages; numbers used with scientific and engineering notations; and sums of money (except round sums used alone). Four digit numbers are written without commas. Five or more digit numbers are written with commas or in scientific notation. Deviations from this practice as are standard in the author's field are, of course, permitted.

Abbreviations and Symbols

When using abbreviations, the author is expected to follow the practice of standard journals in his/her field. The following guidelines are used:

1. Do not mix abbreviations and names in the same expression.
ft/min or feet per minute, not feet/min
m/s or meters per second, not meters/second or meters/s
2. Do not express plurals by adding an "s".
10 Btu, not Btu's or Btus; 1 kg, 14 kg
3. Do not use periods with abbreviations, except when abbreviating "inches" not raised to a power.

min, ft, in., in², s (not sec), m, mm

4. An abbreviation is capitalized when it abbreviates a proper noun and is lower case when it abbreviates a prefix or a common noun. For example

J ("Joule" is a proper noun).

Btu ("British" is a proper noun; thermal and unit are common nouns).

kW ("Watt" is a proper noun; kilo is a prefix).

mm ("milli" is a prefix; "meter" is a common noun).

5. Leave a space between the numerical value and the abbreviation

100 W, 10 cfm, 55 mm

except between number and degree of plane angle.

6. The degree symbol is unnecessary with temperatures.

62 F, 20 C

7. Use only one solidus per expression, and separate units with a raised dot.

Btu/ft²·min·F W/m²·h·C

8. The words "equation", "figure" and "table" are capitalized and spelled out at the beginning of a sentence, but the abbreviations "Eq." and "Fig." may be used inside sentences. "Table" may not be abbreviated. Equation numbers are enclosed in parentheses.

inserting Equation (6) ... or inserting Eq. (6) ...

When a number of equation manipulations are being performed, the equation may be referred to by simply enclosing its number in parentheses.

inserting (6.1) and (6.2) into (7.1) yields ...

Quotations

Quotations less than two sentences or four typed lines in length are incorporated into the text of the thesis and enclosed in double quotation marks. In all cases, commas and periods are placed inside quotation marks. This practice is followed whether the ending punctuation mark is a

part of the quotation or not. Question marks and exclamation points are placed inside the quotation marks if they are a part of the quotation, outside them if they are not.

Quotations of more than two sentences or four typed lines in length are set off from the body of the text in single spacing and indented as a whole from the left margin. In this case, quotation marks are not used at the beginning and end of the quotation. The original text is followed with regard to quotation marks which may occur within a single-spaced indented quotation. The first line of a quotation is not further indented unless it is the first line of a paragraph in the original text from which the quotation is taken. Paragraphs within the original text are indented, relative to the left margin of the quotation, the same as a paragraph within the text of the thesis.

When any copyrighted material is used extensively, i.e., more than 150 words in a direct quotation, the student must conform to all laws pertaining to the use of copyrighted material. Consult the Graduate School for copyright law information.

Ellipses

For an ellipsis within a quoted sentence use three spaced dots. Try to make quotations that are complete sentences end with periods, even though matter that was within the original sentence may have been omitted. To indicate ellipses after the conclusion of a complete sentence, use four spaced dots, being careful not to leave a space before the first dot, which is the sentence period.

Lists

Items in a list are indented and may be preceded by a number and period, or some form of bullet may be used. For example,

The HVAC system had to be designed to accommodate the following:

1. placement of research equipment and walls anywhere in the laboratory without major modification.
2. minimal energy consumption.

or, using bullets,

The HVAC system had to be designed to accommodate the following:

- placement of research equipment and walls anywhere in the laboratory without major modification.
- minimal energy consumption

Items in a list run into the text are separated by commas, with each item preceded by a number in parentheses. For example,

... accommodate the following: (1) relative equipment first cost, (2) relative future cost of gas and electric energy, and (3) relative amounts of heating and cooling loads.

References

Within the text of an article, references are cited by giving the last name of the author(s) and the year of publication of the reference. The year is always enclosed in parentheses; whether or not the name(s) of the author(s) is also enclosed within the parentheses depends on context.

The two possibilities are illustrated as follows:

.... Prusa(1983) showed that the plume width decreases.

or

.... It was shown that the plume width decreases (Prusa, 1983).

In the case of two authors, last names of both authors are included in the citation. For example, typical citations have the form

Kwon and Pletcher(1981) noticed . . .

or

. . . was recently noticed (Kwon and Pletcher, 1981).

In the case of three or more authors, only the last name of the first author of the reference are necessary; other authors are denoted by "et al." Typical citations have the form

Lee et al. (1982) discovered . . .

or

. . . was discovered (Lee et al., 1982).

In the case of two or more references with the same author(s) and with the same year of publication, the references are distinguished in the text by appending a lower case letter "a" to the year of publication of the first cited, a letter "b" to the second cited, and so on. For example,

Sparrow (1980a) discovered . . .

and, later in the text,

It was also noted (Sparrow, 1980b) that . . .

References to different page numbers of a work previously cited are made by giving the reference and pages in brackets.

. . . solution found in (Smith, 1955, pp. 5-7)

Units

Either U.S. customary (USCS) or SI units may be given preference, but SI units should be included. When USCS units are given preference, the SI units should be given in parentheses or in a supplementary table. When preference is given to SI units, the USCS units may be omitted or given in parentheses.

Equations and Formulas

Equations and formulas either are all centered or indented consistently more than a regular paragraph. A smaller indentation is permissible if this allows a long equation to fit on one line. Other equations on the same page have the same indentation. Leave one space above and below the displayed equation.

Equations and formulas referred to later in the text should be numbered. If so, they are numbered with Arabic numerals either running consecutively throughout the thesis [as Eq. (1), Eq. (2)] or numbered by chapter [as Eq. (2.1), Eq. (2.2)]. The number is usually placed in line with and at the right of the first line of the formula or equation, and it is enclosed in parentheses but has no other punctuation. The closing parenthesis mark is in line with the right hand margin.

Examples are given below.

If a list of definitions of symbols used in the equation follows, it begins in an indented column. When the word "where" separates the quotation and list of definitions, it is flush left and all lower case. Definitions may also appear in paragraph form. Leave one space after the last definition. For example,

$$a^2 + b^2 = f^2 \quad (2.1)$$

where

$$a^2 = \text{apples}$$

$$b^2 = \text{peaches}$$

$$f^2 = \text{fruit salad}$$

If only one or two definitions are needed they can be simply included in the sentence following the equation. For example

$$y = 3t + 6$$

where t = time in s, and y = displacement in ft.

If more than one line is needed to display a long equation, break it before an operational sign (+, -, \div , /, *), align the operational signs on the left, and leave one space between the parts of the equation.

$$E = (a + b + c)/(m + n + o) \\ * (d + e + f)$$

If two or more displayed equations are grouped together, leave a space between the individual equations.

$$a + b = c$$

$$D = f - ab^2$$

$$mon = rst$$

In a highly mathematical or theoretical paper, it may be advisable to develop equations in appendices rather than in the body of the paper.

Thesis Illustrations

Illustrations of all types, including graphs, are called figures. They are either numbered consecutively in Arabic numerals in one group from beginning to end of the thesis, (as Figure 1, Figure 2) or numbered by chapter (as Fig. 5.2) or separately in the Appendix (as Fig. A.6). Each figure must have a title. Other requirements are

1. Minimum margins are those required for the normal page.
2. If possible, various standard types of broken lines rather than colors should be used for multiple curves so they can be distinguished on a black and white copy.
3. The title of each figure is at the bottom of the illustration. Only the first word of the title is capitalized. Put a period after the figure number and leave a space between the figure number and title. Do not abbreviate "figure" in the caption. For example,
Figure 4. Schematic diagram of the F-42 rationalizer
The title of the figure as it appears in the "List of Illustrations" must duplicate the title under the caption.
4. For large illustrations, charts or diagrams that cannot be reduced to the size of one page, consult the UA thesis guide, Graduate School, or Library.

Graphs

A graph may be said to be a pictorial representation of the mathematical relationship between two variables. For the average reader, a graph is more easily understood than the mathematical expression it represents. The ideal graph is one that, together with its caption, is practically self-explanatory and self-sufficient.

To accomplish its purpose, the background grid (as determined by tic marks) on which the curves are drawn must be simple and easily understood at a glance. The proportions must be appropriate and the scales calibrated in a logical manner.

Graphs should have relatively few tic marks. Legends and essential lettering are included in a way that does not interfere with the curves. Explanatory notes are put in the caption, together

with the title of the graph. In general, the scales and units of measure on all graphs are placed along the bottom and left-hand sides. Linear scales are arranged so that the tic marks shown correspond to 1, 2, or 5 units of measurement, or to such units multiplied or divided by 10, 100, etc. For example, use scales like: 0, 1, 2, 3, 4, 5, 6 ..., or 0, 2, 4, 6, 8, 10 ..., or 0, 5, 10, 15, 20 ..., or 10, 20, 30, 40 ..., or 100, 200, 300 Scales such as the following are awkward and should not be used: 0, 3, 6, 9, 12, 15, 18 ..., or 0, 4, 8, 12, 16, 20, 24 ..., or 0, 6, 12, 18, 24, 30 ..., or 0, 15, 30, 45, 60.... Log scales should show tic marks at each decade and factors of 2, 3, 4, 5, 6, 7, 8, 9, or 2, 4, 6, 8, or just 5.

If a graph is drawn using USCS units, conversion factors should be given in the figure caption to enable the reader to convert all of the measurements used in the graph to SI units. If the graphs are drawn using SI units, the conversion factors, if required, may be given for conversion to USCS units.

In the interest of saving space, as well as to facilitate direct comparison, it is often desirable to draw several curves on the same graph. However, care should be exercised not to include so many that the result will be confusing. Where series of separate graphs with similar magnitudes of the same variable are presented, the scales and dimensions of the background grid should be kept the same to permit the reader to make direct comparisons without having to make mental adjustments for changes in the "background".

Illustrations for Publications

Figures published in technical papers are often reproduced in a size to fall within a printed column, i.e., the overall width of the reproduction, including all lettering, is about 80 mm (3.25 in.). If the thesis figures are also to be used in a paper, this reduction must be accounted for in preparing the originals to assure legibility in the printed reproduction. For satisfactory results the minimum height of lettering in the reproduction must not be less than approximately 2 mm (0.08 in.). This means that an original made in the customary 220x280 mm (8.5 x 11 in.) size must have lettering about 5 mm (0.2 in.) in height. Lettering on originals of larger size should be made

proportionately larger. Methods producing lettering of heavier weight than typing should be used wherever possible. The effect of reduction on the weight of lines used in the original should also be taken into account. The weight of line used for the curves should be appreciably greater than that used for the tic marks.

Tables

An example of the proper form to use in setting up tables is given in the Appendix. For numbering of tables, see instructions under "Thesis Illustrations." The table number and title are placed above the table. Each table must have a title, which is typed with the first word capitalized.

Tables consist of information or data arranged in vertical columns. If there is an index column, it should always be the first or left-hand column. In tables having a great many columns it is often advantageous to repeat the index column on the right-hand side. Where long columns of figures are tabulated, it is good to divide them horizontally into groups of five, ten, etc., to make the reading easier.

The identity of the data in each column, the units of measure, and other necessary qualifying information should be placed at the top of the column. Column headings should be brief, specific, and completely intelligible so there can be no chance for misunderstanding. Because of space limitations, abbreviations are usually necessary, but only standard abbreviations are used. Where space is inadequate, symbols or characters may be used in column headings and defined in a footnote.

When large numbers are included in a table, they should be in terms of thousands, millions, etc., with the proper notation in the column heading. In some instances it is possible to use larger units of measure to reduce the number of digits in the number, such as kilowatts, megawatts, etc. Where a high degree of accuracy is not necessary, particularly where the accuracy of the figures cannot be justified, it is better to round off large numbers. For example, in place of tabulating a length of 1321 m (4330 ft), where that number is obtained only by carrying out the computation to three significant figures, use 1.32 km (4.33×10^3 ft).

If a table uses USCS units, conversion factors should be given in a footnote to enable the reader to convert all of the measurements used in the table to SI units. Conversely, tables in SI units may give conversion factors that yield USCS equivalents. Special care should be used with decimal quantities. The number 1.3 is not the same as 1.30 or 1.3000. A measurement of 1.3 indicates accuracy to the nearest one-tenth; 1.30 indicates accuracy to the nearest one-hundredth.

TYPICAL THESIS BODY

The main body of the thesis typically gives the reader essentially the information suggested by the following items:

1. Introduction
2. Theory and Analysis
3. Instrumentation and Equipment
4. Procedure
5. Results and Discussion
6. Conclusions
7. Recommendations

While the first chapter is usually entitled "Introduction," the student is not required to follow the suggested outline so far as titles for chapters are concerned; nor is it expected that every thesis will develop each of the items listed. The character of the work may make modifications desirable. A thesis solely of analytical work, for example, will probably have chapter(s) on theory and analysis but may not have a chapter devoted to instrumentation and equipment; and it is quite possible that the procedure, whether experimental or analytical, may logically need more than one chapter for adequate treatment. It is strongly recommended, however, that the development of the text follow the overall outline indicated above. It is a logical sequence in the presentation of research, and experience has shown that it enables the reader to follow the essential details with the greatest degree of understanding.

A good test for the clarity and completeness of the text is whether or not a person reasonably familiar with the subject could use the description of what was done as a guide to follow through the same work and duplicate the results given.

Introduction

The Introduction (normally Chapter I) should be a concise statement of the problem with

regard to

1. Definition of the problem.
2. Brief history leading to the problem.
3. Purpose and scope of the research.
4. Review of the literature, indicating briefly what has already been done along the line of the problem, the difficulties that may have been encountered by other researchers, criticisms of previous approaches, etc. If this item is extensive, the writer may wish to treat it as a separate chapter following the Introduction.
5. Brief statement of the methods used in the research intended to provide a bridge to sections which follow.
6. Definition of terms. A list of definitions may be needed if many terms unfamiliar to a typical reader are used. A separate chapter may be justified if the list is extensive or if the definitions are long and detailed. This section may be placed in the appendix if it is only moderately long.

The primary purpose of the Introduction is to give the reader an insight into the problem, to arouse interest, and to update the reader on the background for the thesis writer's research.

Theory and Analysis

The equations modeling the system being considered are developed and presented. Simplifying assumptions are given and justified. The theoretical basis for an experimental technique may also be developed. Lengthy derivations should be carried out in an appendix with only important results presented in the text.

Instrumentation and Equipment

Instrumentation and equipment are described and illustrated with sufficient precision so that a skilled person could set up the apparatus for a duplication of the research if necessary or desirable. Nonessential detail not affecting the results is omitted.

Procedure

The procedure followed in the research is described with sufficient clarity and detail so that the reader could duplicate the reported operations if he/she wishes. Nonessential detail which did not contribute to the results or conclusions is be omitted. The order of presentation need not follow the chronological order in which work was done.

Results and Discussion of Results

These sections are an abstracted or generalized description and interpretation of data contained in the report. Tables, charts, and curves of a summary nature are included in this section. The greater bulk of the raw research data, however, is reserved for the Appendix, and the reader is referred to that section if he/she wishes to verify statements. This discussion points out highlights and items of significance in the data and affords the author an opportunity to focus the attention of the reader toward whatever phases of the results he/she deems most important. The "Results" are the hard facts presented in the actual data. The "Discussion" is the writer's interpretation of those facts.

Conclusions

The conclusions summarize the results of the research reported in the thesis. They are based on factual findings previously reported in "Results". Each separate conclusion should be a one-sentence statement, and the conclusions as a whole should be listed in a logically sequential order. Since conclusions are often lifted out of the context of the thesis and quoted without the accompaniment of explanatory material that may precede and follow them, care should be taken in composing each conclusion to be sure that it does not imply a broader scope than is intended and that it includes the necessary qualifications.

Recommendations

In many instances the work done in procuring information and test data for a thesis uncovers many interesting and valuable related problems. The recommendations are, therefore, an expression of the author's advice regarding future improvements or suggestions for future related research. They are based on the experience gained during the thesis work; and though they may be no more than opinions (which are permissible in this section of the thesis) or tentative hypotheses, they may prove to be of considerable value to later researchers working in the same or a similar area.

References

References to original sources for cited material are listed together at the end of article; footnotes are not used for this purpose. References are arranged in alphabetical order according to the last name of the first-named author for articles with more than one author. The list of references contains complete information, and the following general rules apply:

1. Give last name and initials of author in inverted order (Smith, A.B.). If there are no more than three authors, give all names. If there are more than three, one may give only the first author's name plus "et al."
2. Use initial capitals in all main words in titles (of papers, articles, books, reports).
3. Separate all items in citation by commas.
4. Give inclusive page numbers where applicable.
5. The first line of the citation is indented. Each citation is single spaced with double spacing between citations.

For journal or proceedings articles:

- Give items in the following order: author(s), year, title of article, journal or proceedings name, volume number (if any), issue number, inclusive page numbers.
- Put title of article in quotes.
- Spell out journal or proceedings title in full; underline or italicize.

- Give volume number as "Vol. 1" in Arabic type.
- Give inclusive page numbers as "pp. 35-38."

For books, theses, technical reports:

- Give items in the following order: author(s), year, chapter or article title (if applicable), book title, edition number (if necessary), volume number (if necessary), publisher, publisher's locations (city only, or city and state, if necessary), page number(s).
- Put the chapter or article title in quotes.
- Underline or italicize the book title.
- Give the edition number as "1st ed."
- Give the volume number as "Vol. 1."
- Give the publisher's name in shortened form ("Macmillan," not "The Macmillan Company").
- Identify an editor as "Smith, A.B., ed."

Examples are given in the Appendix.

Appendices

The appendix or appendices contain the bulk of the research data or findings as embodied in the tables, diagrams and sketches, curves, and photographs. It contains such items as sample computations and derivations, sample schedules, and computer codes. The purpose of the appendix is to make available to the reader those details of data that verify the summary statements reported under "Results" in the text but would obscure the development of the presentation if included in the main body of the thesis.

If there is more than one appendix, each is identified with a letter in sequence (Appendix A, Appendix B, etc.). Figures, tables, and equations in the appendix are labeled with the same letter and numbered in sequence (A.1, A.2, B.1, B.2, etc.).

As mentioned above, tables, charts, curves, photography, etc., which advance the presentation rather than retard it are included in the text. The "Nomenclature" or "Definitions" may also be included as an appendix instead of having separate sections or chapters for them.

APPENDIX

(Table Example)

Table 6. Record of rail failures in welded track

Item	Welded Summer	Failure Winter	Joint ft	Break in.	Weld Structure
1	1917	1921	30	1.0	Coarse
2	1917	1922	400	1.2	Coarse
3	1918	1922	250	2.0	Coarse
4	1920	1926	520	2.1	Coarse
5	1920	1927	300	0.7	Fine
6	1921	1932	0*	0.3	Medium
7	1927	1933	100	1.3	Medium
8	1928	1933	130	1.0	Fine
9	1930	1936	110	0.7	Coarse

* No data available.

(For a figure, the title is placed underneath. This table could be placed lower if desired; any attractive placement on the page is permitted if margins are not violated.)

(Sample List of Tables)
LIST OF TABLES

Table	Page
1. Fuel consumption influenced by road surfaces	6
2. Coefficients of friction for various road surfaces	16
3. Compressive strength comparisons for bituminous mixes	24
4. Shearing strength comparisons for bituminous mixes	47
5. Deflection measurements on a bituminous concrete pavement	57
6. Survey of edge conditions of Wayne County	61
7. Maintenance costs of Wayne County pavements	70

(The List of Illustrations should follow this form.)

(Sample Nomenclature)
NOMENCLATURE

C volumetric heat capacity ($\text{J}/\text{m}^3\cdot\text{K}$)

C_p, C_v specific heats ($\text{J}/\text{kg}\cdot\text{K}$)

D_{13} modified molecular diffusivity of water vapor in air (m^2/s)

$D_{\theta a}, D_{\theta l}, D_{\theta v}$ isothermal air, liquid, vapor diffusivities (m^2/s)

Fo Fourier Number = $\alpha_0 t/x^2$

h enthalpy (J/kg)

q'' energy flux (W/m^2), a vector

Greek Symbols

α thermal diffusivity (m^2/s)

ϵ porosity (m^3/m^3)

θ volumetric liquid moisture content (m^3/m^3)

Subscripts

0 dry, boundary

1, 2, 3 vapor, liquid, air

b bulk flow

i initial

* without mass movement

Superscripts

+, - ahead, behind front

* dimensionless

(Sample References)

REFERENCES

Kwon, O.K., and Pletcher, R.H., 1981, "Prediction of the Incompressible Flow Over a Rearward-Facing Step," Technical Report HTL-26, CFD-4, Iowa State Univ., Ames, IA.

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Sparrow, E.M., 1980a, "Fluid-to-Fluid Conjugate Heat Transfer for a Vertical Pipe--Internal Forced Convection and External Natural Convection," *ASME Journal of Heat Transfer*, Vol. 102, pp. 402-407.

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Tung, C.Y., 1982, "Evaporative Heat Transfer in the Contact Line of a Mixture," Ph.D. Thesis, Rensselaer Polytechnic Institute, Troy, NY.

Turner, M.J., et al., 1964, "Applications of Stiffness Method," *Matrix Structure Analysis*, 1st ed., Vol. 1, Macmillan, New York, pp. 203-266.