Appendix B

Using \LaTeX

There are a number of excellent texts and web sites that describe \LaTeX and how to use it to produce very professional-looking documents. For example, see Lamport [1] and Diller [2]. New, more user-friendly versions of \LaTeX are becoming available.

In this appendix only a “bare bones” approach to using \LaTeX is presented. First is an example of a laboratory exercise technical memo format. Following that is a list of the \LaTeX commands that were used to generate the memo. Next, some equations produced using \LaTeX are given, followed by the \LaTeX commands used to generate them. Finally, some instructions are given showing how to generate a \LaTeX document on a UNIX operating system.

B.1 Example of a Technical Memo

AME250: MEASUREMENTS

Technical Memo No. 00-1

Subject: Put the title of the exercise here
Submitted by: Your name
Performed with: Your partner’s name
Date exercise performed: Jan. 29, 2000
Date submitted: Feb. 1, 2000

Summary: This should be one paragraph that summarizes the important results and states the significant conclusions. Refer to the AME250 class notes about this section’s content.

Findings: Again, refer to the AME250 class notes about what should be included in this section. Figures in Postscript can be included as per the example shown here. You can refer to a figure by saying that Figure B.1 shows the output $y(t)$ versus the dimensionless time, $t/\tau$. Each figure should have its own caption and should be
<table>
<thead>
<tr>
<th>Water depth (mm)</th>
<th>Gate angle (°C)</th>
<th>Measured force (N)</th>
<th>Theoretical force (N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>22</td>
<td>45</td>
<td>11.2</td>
<td>14.5</td>
</tr>
<tr>
<td>36</td>
<td>45</td>
<td>18.7</td>
<td>17.8</td>
</tr>
<tr>
<td>55</td>
<td>30</td>
<td>3.4</td>
<td>5.5</td>
</tr>
</tbody>
</table>

Table B.1: Hydrostatic force on an inclined plane wall

placed as close as possible to its citation (\LaTeX will place the figures and tables, so don’t worry about it too much).

![Graph](image)

Figure B.1: First-order system response.

Define each symbol in the text. For example, you can say that the calibration curve for a certain device is:

\[ y = Kx \]  

where \( y \) is in Pa and \( x \) in Volts. A more complicated equation would be:

\[ u_q = \sqrt{\left( \frac{\partial q}{\partial x_1} u_{x_1} \right)^2 + \ldots + \left( \frac{\partial q}{\partial x_k} u_{x_k} \right)^2}. \]  

Later in the text you can refer back to Equations B.1 and B.2. If you need a table, an example is shown in Table B.1. Remember to include a caption. Of course if you choose to put symbols such as \( x \) or \( y \) you must define them also.

You may choose to itemize some of your findings as
• The calibration represented by Equation (B.1) has a bias error, perhaps one of
calculation or misreading of units during measurement.

• And this is another comment.

References:

1. First reference goes here

2. Second reference goes here

The following are the \LaTeX commands that were used to generate the previous
technical memo.

\documentstyle[12pt,psfig]{article}
\textwidth=6in
\textheight=8in
\topmargin=0.5in
\oddsidemargin=0.25in
\evensidemargin=0.25in
\headheight=0in
\footheight=0in
\headsep=0in

\begin{document}
\centerline{\Large \bf AME250: MEASUREMENTS}
\bigskip

\centerline{\Large \bf Technical Memo No. 00-1}
\bigskip
\bigskip
\noindent {\bf Subject:} Put the title of the exercise here

\noindent {\bf Submitted by:} {\it Your name}

\noindent {\bf Performed with:} {\it Your partner’s name}

\noindent {\bf Date exercise performed:} Jan. 29, 2000

\noindent {\bf Date submitted:} Feb. 1, 2000
\bigskip
\noindent {\bf Summary:} This should be one paragraph that
summarizes the important results and states the significant conclusions. Refer to the AME250 class notes about this section’s content.

\bigskip

\noindent {\bf Findings:} Again, refer to the AME250 class notes about what should be included in this section. Figures in Postscript can be included as per the example shown here. You can refer to a figure by saying that Figure~\ref{this} shows the output $y(t)$ versus the dimensionless time, ${t/\tau}$. Each figure should have its own caption and should be placed as close as possible to its citation (\LaTeX\ will place the figures and tables, so don’t worry about it too much).

\begin{figure} [h]
\centerline{\psfig{figure=fordstep.eps, width=4.0in}}
\caption{First-order system response.}
\label{this}
\end{figure}

Define each symbol in the text. For example, you can say that the calibration curve for a certain device is:

\begin{equation}
y=Kx
\end{equation}

\label{calib}
\end{equation}

\noindent where $y$ is in Pa and $x$ in Volts. A more complicated equation would be:

\begin{equation}
u_q=\sqrt{\left(\left\{\frac{\partial q}{\partial x_1}\right\}_{x_1}u_{x_1}\right)^2+\ldots+\left(\left\{\frac{\partial q}{\partial x_k}\right\}_{x_k}u_{x_k}\right)^2}.
\end{equation}

\label{aqeqn}
\end{equation}

Later in the text you can refer back to Equations~\ref{calib} and \ref{aqeqn}. If you need a table, an example is shown in Table~\ref{wall}. Remember to include a caption. Of course if you choose to put symbols such as $x$ or $y$ you must define them also.

\begin{table}
\begin{center}
\begin{tabular}{|c|c|c|c|}
\hline Water depth & Gate angle & Inward force & Outward force \\
\hline \text{(mm)} & $(\text{circ C})$ & $(N)$ & $(N)$ \\
\hline 22.45 & 11.2 & 14.5 \\
\hline 36.45 & 18.7 & 17.8 \\
\hline 55.30 & 3.4 & 5.5 \\
\hline
\end{tabular}
\caption{Hydrostatic force on an inclined wall} \label{wall}
\end{center}
\end{table}

You may choose to itemize some of your findings as
\begin{itemize}
\item The calibration represented by Equation (\ref{calib}) has a bias error, perhaps one of calculation or misreading of units during measurement.
\item And this is another comment.
\end{itemize}
\bigskip

\noindent{\bf References:}
\begin{enumerate}
\item First reference goes here
\item Second reference goes here
\end{enumerate}
\bigskip

\section*{B.2 Examples of Equations Used in this Book:}

\begin{equation}
 p(x) = \lim_{N \to \infty, \Delta x \to 0} \sum_{j=1}^{K} \left( f_j / \Delta x \right) 
\end{equation}

\begin{equation}
 dt = dx / \left[ x_0 \omega \sqrt{1 - \sin^2 \omega t} \right] = dx / [x_0 \omega] , \quad \text{(B.4)}
\end{equation}

\begin{equation}
 = dx / \left[ \omega \sqrt{x_0^2 - x^2} \right] = \frac{T}{2\pi \sqrt{x_0^2 - x^2}} \ dx. \quad \text{(B.5)}
\end{equation}
\begin{equation}
\langle (x - x')^m \rangle \equiv \int_{-\infty}^{+\infty} (x - x')^m p(x) dx = \mu_m = E [(x - x')^m]. \tag{B.6}
\end{equation}

\begin{equation}
\mu_m = \sum_{i=0}^{m} (-1)^i \binom{m}{i} \mu_i \mu_{m-i} \quad \text{where} \quad \binom{m}{i} = \frac{m!}{i!(m-i)!}. \tag{B.7}
\end{equation}

\begin{equation}
Prob[x_1^* \leq x \leq x_2^*] = P(x_2^*) - P(x_1^*) = \int_{x_1^*}^{x_2^*} p(\xi) d\xi \tag{B.8}
\end{equation}

\begin{equation}
P(-x_1 \leq x \leq +x_1) = \int_{-x_1}^{+x_1} p(x) dx, = \int_{-x_1}^{+x_1} \frac{1}{\sigma \sqrt{2\pi}} \exp \left[-\frac{1}{2\sigma^2}(x - x')^2\right] dx. \tag{B.9}
\end{equation}

\begin{equation}
\frac{\nu S_x^2}{\chi^2_{\alpha/2}} \leq \sigma^2 \leq \frac{\nu S_x^2}{\chi^2_{1-\alpha/2}} \tag{B.10}
\end{equation}

\begin{equation}
S_x^2 = \frac{1}{(M-1)N^2} \sum_{i=1}^{N} \sum_{j=1}^{M} d_{ij}^2 = \frac{1}{N} \left[ \frac{1}{N(M-1)} \sum_{i=1}^{N} \sum_{j=1}^{M} d_{ij}^2 \right]. \tag{B.12}
\end{equation}

The following are the \LaTeX\ commands used to generate the above equations.

\begin{verbatim}
\begin{equation}
p(x)=\lim_{N \rightarrow \infty, \Delta x \rightarrow 0} \sum_{j=1}^{\{K\}} (\delta_{j, \Delta x}) \end{equation}
\end{verbatim}

\begin{verbatim}
\begin{eqnarray}
dt &=& dx/\left[x_o \omega \sqrt{1-\sin^2 \omega t}\right] = dx/\left[x_o \omega \sqrt{1-\omega^2}\right], \quad \quad \\
&=& dx/\left[\sqrt{x_o^2-2x^2}\right] \left[T/\pi \sqrt{x_o^2-2x^2}\right]. \end{eqnarray}
\end{verbatim}

\begin{verbatim}
\begin{equation}
\langle (x-x')^m \rangle \equiv m! \left(\int (x-x')^m p(x) dx = \mu_m = E [(x-x')^m]. \right. \end{equation}
\end{verbatim}

\begin{verbatim}
\begin{equation}
\mu_m = \sum_{i=0}^{m} (-1)^i \binom{m}{i} \mu_i \mu_{m-i} \quad \text{where} \quad \binom{m}{i} = \frac{m!}{i!(m-i)!}. \end{equation}
\end{verbatim}

\begin{verbatim}
\begin{equation}
Prob[x_1^* \leq x \leq x_2^*] = P(x_2^*) - P(x_1^*) = \int_{x_1^*}^{x_2^*} p(\xi) d\xi \end{equation}
\end{verbatim}

\begin{verbatim}
\begin{equation}
P(-x_1 \leq x \leq +x_1) = \int_{-x_1}^{+x_1} p(x) dx, = \int_{-x_1}^{+x_1} \frac{1}{\sigma \sqrt{2\pi}} \exp \left[-\frac{1}{2\sigma^2}(x - x')^2\right] dx. \end{equation}
\end{verbatim}

\begin{verbatim}
\begin{equation}
\frac{\nu S_x^2}{\chi^2_{\alpha/2}} \leq \sigma^2 \leq \frac{\nu S_x^2}{\chi^2_{1-\alpha/2}} \end{equation}
\end{verbatim}

\begin{verbatim}
\begin{equation}
S_x^2 = \frac{1}{(M-1)N^2} \sum_{i=1}^{N} \sum_{j=1}^{M} d_{ij}^2 = \frac{1}{N} \left[ \frac{1}{N(M-1)} \sum_{i=1}^{N} \sum_{j=1}^{M} d_{ij}^2 \right]. \end{equation}
\end{verbatim}
\begin{equation}
Prob[x_1^{\text{\prime}}\leq x \leq x_2^{\text{\prime}}]=P(x_2^{\text{\prime}})-P(x_1^{\text{\prime}})=
\int_{x_1^{\text{\prime}}}^{x_2^{\text{\prime}}} p(x_i) \, dx
\end{equation}

\begin{eqnarray}
P(-x_1 \leq x \leq +x_1)&=&\int_{-x_1}^{+x_1} p(x) \, dx, \\
&=&\int_{-x_1}^{+x_1} \left[1+\sigma \sqrt{2\pi}\right] \exp \left[-\frac{1}{2}\left( x-x^* \right)^2 \right] dx.
\end{eqnarray}

\begin{equation}
\nu S_x^{\text{\prime}} \leq \chi_{\{\alpha/2\leq\nu\}} \leq \nu S_{x^{\text{\prime}}}
\end{equation}

\begin{equation}
\nu S_x^{\text{\prime}} \leq \chi_{\{1-\alpha/2\leq\nu\}}
\end{equation}

\begin{equation}
S_{\{\bar{x}\}}^{\text{\prime}}=\left\{1+\over(M-1)N-2\right\}\sum_{i=1}^{N}\sum_{j=1}^{M}\left[\left\{1+\over N\right\}\left[1+\over N(M-1)\right]\right] \\
\label{eq:}\end{equation}

\section*{B.3 \LaTeX{} Technical Report Style Syntax}

The following lists the syntax used by \LaTeX{} to generate a technical report according to the suggested format.

\documentclass[12pt]{report}
\usepackage{lscape}
\usepackage[dvips]{epsfig}
%\usepackage{makeidx}
\renewcommand{\baselinestretch}{1}
\setlength{\textheight}{9in}
\setlength{\textwidth}{6.0in}
\setlength{\headheight}{0in}
\setlength{\headsep}{0in}
\setlength{\topmargin}{0in}
\setlength{\topmargin}{0in}
\setlength{\oddsidemargin}{.5in}
\setlength{\evensidemargin}{0in}
\setlength{\parindent}{.3in}
\def\doublespace{enewcommand{\baselinestretch}{2}\large\normalsize}
\def\singlespace{enewcommand{\baselinestretch}{1}\large\normalsize}
\def\halvespace{enewcommand{\baselinestretch}{1.5}\large\normalsize}

\begin{document}

\title{project title goes here}

\author{student names go here \ AME250: Laboratory Exercise No. 5
\ Department of Aerospace and Mechanical Engineering\ University of Notre Dame \}

\date

\maketitle

\tableofcontents

\include{Abstract}
\include{Nomenclature}
\include{Introduction}
\include{Approach}
\include{Results}
\include{Discussion}
\include{Conclusions}
\include{References}

\end{document}

\subsection{How to \LaTeX{} a Document}

This is how to \LaTeX{} your document on a UNIX operating system.

1. Prepare your document using the text editor, then save it as name.tex, where name is arbitrary. Also be sure to place your figures (best saved as .eps files) in the same directory as name.tex.

2. Staying in the same directory that name.tex resides, type the command “latex name.tex”. \LaTeX{} will run through your .tex file and “latex” it. If there are errors, it will tell you what lines they are on. Once you have cleaned up all the errors by editing your .tex file, “latex” the file again.

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3. Now type (again) the command “latex name.tex” a second time (or !l as a shortcut this time). This allows \LaTeX to go over your document a second time in order to number your equations, figures, tables, etc.

4. Next type the command “dvips name.dvi -o name.ps”. This creates a postscript file that you can view.

5. Then type the command “ghostview name.ps” to view the document. You can print from the ghostviewed document.

6. Finally, you may want to generate a .pdf file from your .ps file in order to view the document on something other than a Sparc station. To do this, simply type the command “distill name.ps”. This will generate the file name.pdf.
Bibliography
