The Case for LaTeX

Henry Ginn

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1 Introduction

This document gives a brief overview of what LaTeX (pronounced "Lay-tek") is and highlights some of the advantages it has over Microsoft Word. LaTeX is a well-established piece of typesetting software mainly used in academia for technical documents such as papers. The input is given in plain text and then the LaTeX compiler produces a PDF. I understand why you may be wary of any potential barriers to those less comfortable with technology, but the payoff is more than worth it and LaTeX is far simpler than it may seem.

The main advantages are as follows:

- Less buggy than Word
- No need to worry about formatting - template is followed automatically
- Equations, cross-references, and citations are far easier than in Word
- Vector image compatible
- Images are given by reference
- The LaTeX compiler knows how to typeset better than you so documents look professional

In section 2 we elaborate on why LaTeX formatting is easier than in Word, followed by the advantages when writing technical documents in section 3. We finish with a discussion on the accessibility of LaTeX and the practicality of using it on a project in section 4 before concluding.

2 Formatting

We begin by outlining the problems with formatting in Word, even by a trained practitioner who knows how to use Word properly. Throughout this section I will assume that an inconsistent document makes us look unprofessional and that fixing issues around inconsistent or poor formatting is trivial nonsense that is a waste of our time and our client's money.

First of all, it is easy to break the template in Word. Many times I have had section numbering disappear even though the numbering is part of the section header style which was not updated. This was not fixed by reapplying the style. There are many such instances where the styles do not apply properly. Once the template is defined the user should not need to put any extra work into ensuring that it is followed - the software should handle this for us.

Often I find Word just does weird things that no one understands and there is no good fix. For example, I have had tables where the boldness of text would not save and the typical solution to a problem like this is to recreate the whole table from scratch of copy and paste everything into a new document (Link to relevant post on Microsoft Helpdesk).

In LaTeX, all formatting rules for elements such as section and subsection styles, spacing, font sizes, headers and footers, et cetera are defined at the start of the document. The template applies globally across the document[1] which makes documents look consistent and only the type of formatting needs to be given. To tell the compiler you are creating new section or subsection, one would write

[1] It is possible to deviate from the template locally if you really want to but typically this is awkward to do. This is because you are trying to defy the compiler which almost always means you are attempting to commit crimes against typesetting and should not be doing whatever you are trying to do.

`\section{Example Section Name}` or `\section{Example Subsection Name}` respectively and to tell it to format as a bullet point list, the following code is used.

```
\begin{itemize}
    \item Example of the first item
    \item Example of the second item
\end{itemize}
```

This method separates the formatting from the content, meaning no time wasted on formatting and consistent documents. LaTeXalso gives a lot more control than Word; as a simple example it is possible to adjust how much weight it should give towards avoiding widows.

3 Technical Writing

One of the main powers of LaTeX is the ability to format mathematics. In equation (1) below is a simple example showing closure of the $SO(2)$ group, something that would be extremely painful to make in Word but is simple in LaTeX.

$$R(\theta)R(\phi) = \begin{pmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{pmatrix} \begin{pmatrix} \cos\phi & -\sin\phi \\ \sin\phi & \cos\phi \end{pmatrix} \tag{1a}$$

$$= \begin{pmatrix} \cos\theta\cos\phi - \sin\theta\sin\phi & -\cos\theta\sin\phi - \sin\theta\cos\phi \\ \sin\theta\cos\phi + \cos\theta\sin\phi & -\sin\theta\sin\phi + \cos\theta\cos\phi \end{pmatrix} \tag{1b}$$

$$= \begin{pmatrix} \cos(\theta+\phi) & -\sin(\theta+\phi) \\ \sin(\theta+\phi) & \cos(\theta+\phi) \end{pmatrix} \tag{1c}$$

$$= R(\theta+\phi) \tag{1d}$$

We note the following that are impossible, awkward, or very manual to do in Word:

- The equations are numbered automatically and we do not need to position them ourselves
- The equations are aligned on the equals sign - I did not need to add spaces to do this
- The whole equation or individual parts such as equation (1b) can be cross-referenced easily
- Much more complicated configurations can be created, such as equations in two columns

Images are inserted by giving a path to the image. This means when the images are updated the document also updates when it is recompiled. Copying by reference means there is one version of the truth which is one of the reasons why copying by value in situations like this is poor practice. I have wasted a lot of time reinserting images into documents because this is not possible in Word.

Word and other Microsoft Office Suite products are very poor at handling vector graphics. As an engineering consultancy, we feature a lot of graphs in our documents, yet we are forced to rasterise them which lowers their quality. The only option I have found that Word is happy with are Enhanced Metafiles (EMF), a format of Microsoft's creation with many problems[2].

4 Ease of Use

5 Conclusion

[2]EMF files do not support transparency. They also do not or antialiasing so all text looks odd as well