CSCM10 Research Methodology
A Taster of LaTeX

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http://www.cs.swan.ac.uk/∼csetzer/lectures/
computerScienceProjectResearchMethods/current/index.html

October 21, 2019

WYSIWYG Systems

- WYSIWYG = "**W**hat **Y**ou **S**ee **I**s **W**hat **Y**ou **G**et".
- What you type in can be seen directly on the screen.
- **Microsoft Office Word** is the main example of a WYSIWYG system.

Advantages/Disadvantages of WYSIWYG Systems

- WYSIWYG systems are relatively easy to use.
- In WYSIWYG systems typesetting to be done by the user.
  - Problem: most users are not professional type setters.
- In most systems (e.g. Word) you can see only the output, but not the formatting information.
  - Difficult to detect that one headline is in 11 pt and another in 12 pt, or one headline in one font, and another in a slightly different font.
  - Therefore output is usually inconsistent.
- Usually output not of printable quality.
- Programming is difficult, definition of macros restricted and difficult.

WYSIWYM

- WYSIWYM = "**W**hat **Y**ou **S**ee **I**s **W**hat **Y**ou **M**ean".
- Instead of doing the typesetting directly the user says:
  - This is a headline.
  - This is a section title.
  - This text is normal text.
  - This is a mathematical formula
- Main examples: TEXand LATEX.

Advantages/Disadvantages of WYSIWYM Systems

- Steeper learning curve.
- Separation of output from input, therefore what you write needs to be compiled into text.
- Can create text in print quality.
  - Many publishers print articles typeset in LaTeX directly, or after adding their own generic macros.
- User sees all formatting information and can therefore produce very uniform text.
- Programmable using macros.
  - Development of macro packages for many purposes.
    - In LaTeX macro packages e.g. for chess, for typesetting proofs, chemical formulas exist.
    - These slides are typeset in LaTeX.

- TeX developed by Donald Knuth in order to typeset a new version of his books "The art of Computer Programming".
- LaTeX (for **La**mport-**TeX**) developed by Laslie Lamport in order to make a more user friendly version of TeX.
  - LaTeX is essentially a macro package on top of TeX.

Use of LaTeX for Reports and Dissertation

- Reports and dissertations can be written using any text processing system.
- Use of LaTeX will in many cases give you an advantage because of the much higher quality of the output.
- Many lecturers (but not all) use LaTeX, especially for scientific publishing.
    - They might help you with LaTeX.

Example

- The following shows an example of LaTeX code (split into 3 codes) plus the output.
- For ease of presentation after each code piece the final output (which is only produced after running latex on the whole code) is shown.
- The source for this file is available from the web page for the lectures by Anton Setzer for this module or here: http://www.cs.swan.ac.uk/∼csetzer/lectures/computerScienceProjectResearchMethods/current/latex/exampleWikipedia/exampleWikipedia.tex

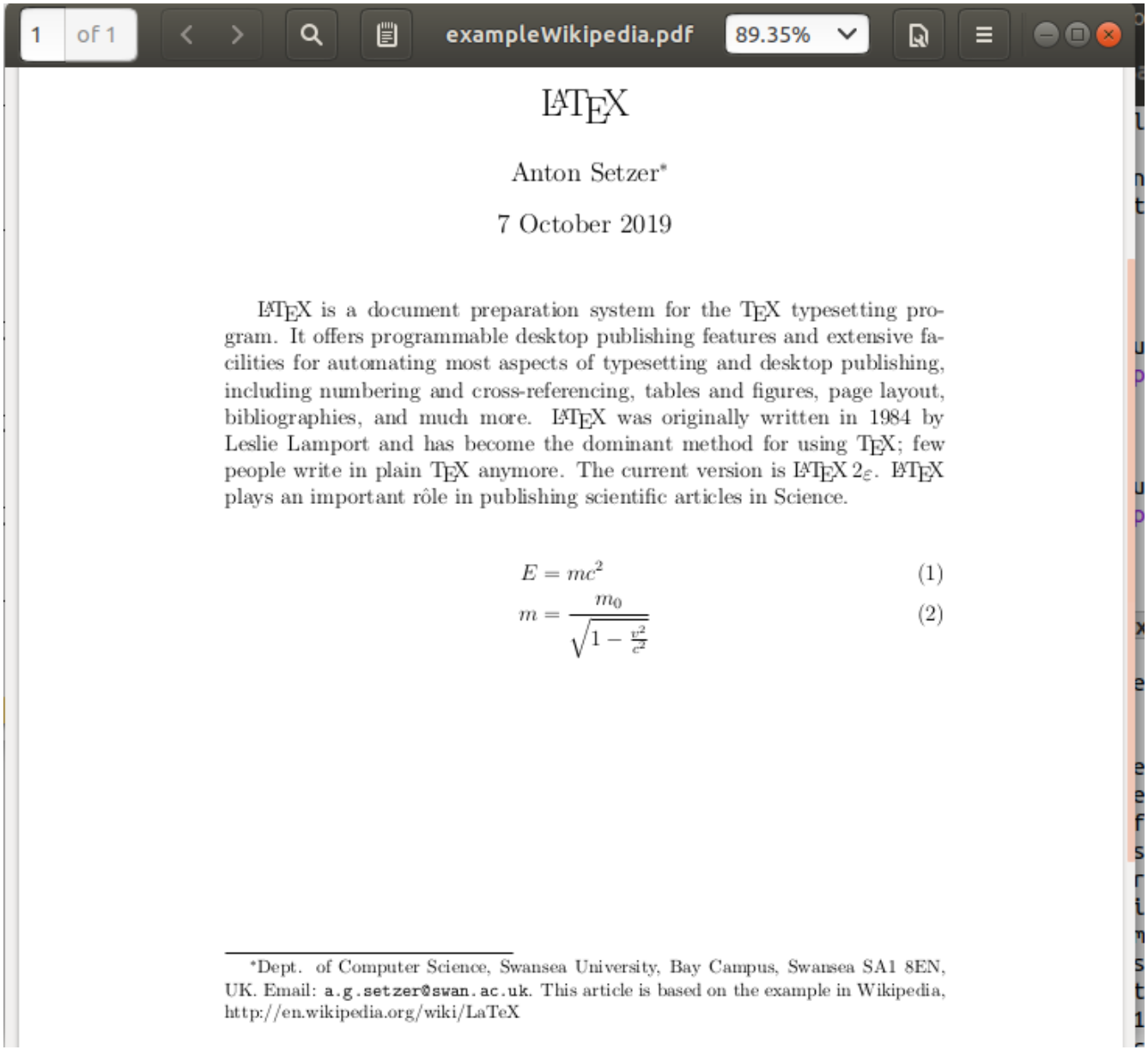
Example

```
\documentclass[12pt]{article}
\usepackage{amsmath}
\title{\LaTeX}
\author{Anton Setzer
  \thanks{Dept.  of Computer Science,
    Swansea University, Bay Campus,
    Swansea SA1 8EN, UK.
    Email:  {\tt a.g.setzer@swan.ac.uk}.
    This article is based on the example in Wikipedia,
    http://en.wikipedia.org/wiki/LaTeX}}
\date{7 October 2019}

\newcommand{\role}{{r\^{o}le}}

\begin{document}
\maketitle
```

LaTeX Output



LaTeX

Anton Setzer*

7 October 2019

LaTeX is a document preparation system for the TeX typesetting program. It offers programmable desktop publishing features and extensive facilities for automating most aspects of typesetting and desktop publishing, including numbering and cross-referencing, tables and figures, page layout, bibliographies, and much more. LaTeX was originally written in 1984 by Leslie Lamport and has become the dominant method for using TeX; few people write in plain TeX anymore. The current version is LaTeX 2_ε. LaTeX plays an important rôle in publishing scientific articles in Science.

$$E = mc^2 \tag{1}$$

$$m = \frac{m_0}{\sqrt{1 - \frac{v^2}{c^2}}} \tag{2}$$

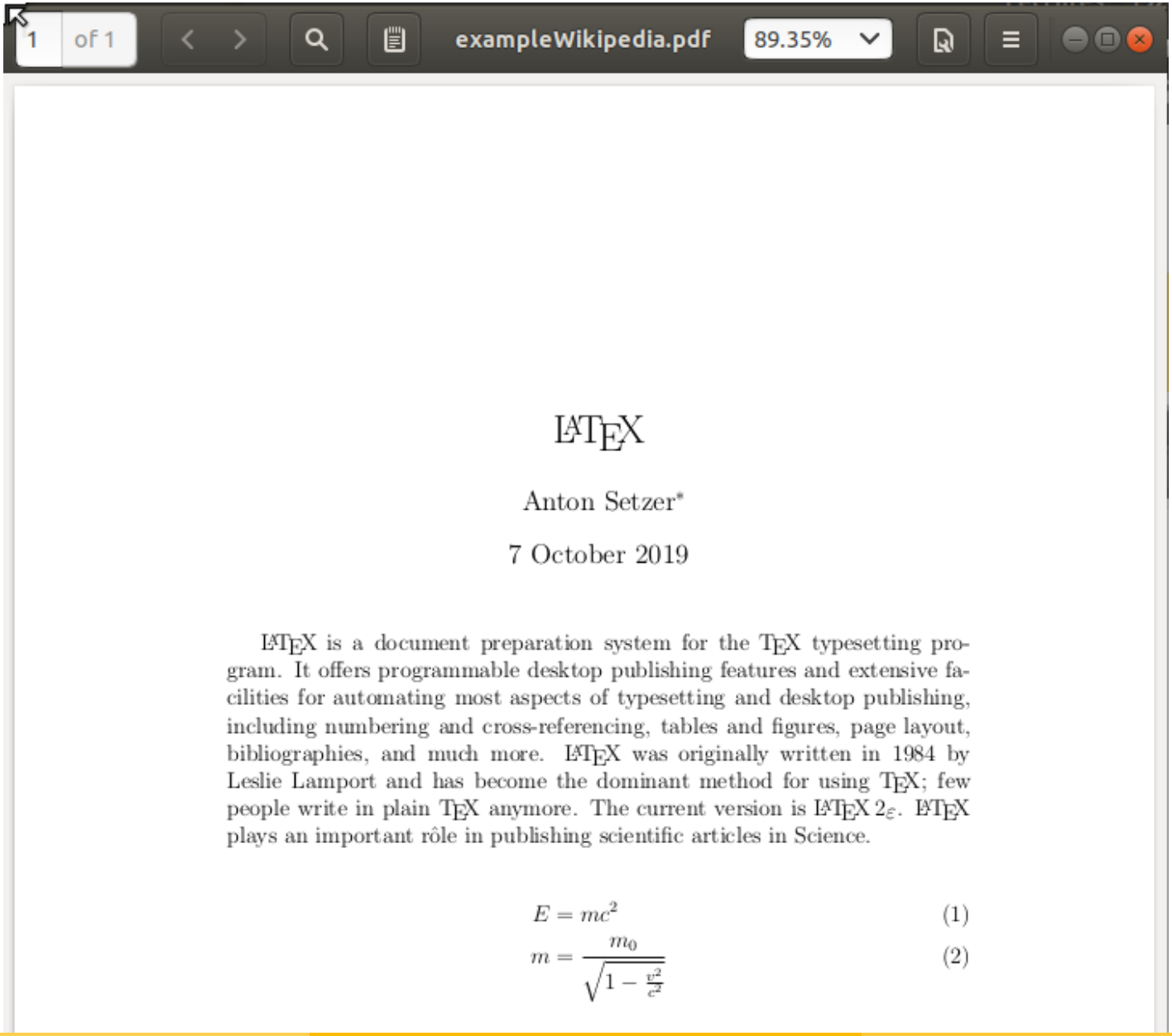
*Dept. of Computer Science, Swansea University, Bay Campus, Swansea SA1 8EN, UK. Email: a.g.setzer@swan.ac.uk. This article is based on the example in Wikipedia, http://en.wikipedia.org/wiki/LaTeX

Example (Continued)

```
\LaTeX{} is a document preparation system for the \TeX{}
typesetting program.  It offers programmable desktop
publishing features and extensive facilities for
automating most aspects of typesetting and desktop
publishing, including numbering and cross-referencing,
tables and figures, page layout, bibliographies, and
much more.
\LaTeX{} was originally written in 1984 by Leslie
Lamport and has become the dominant method for using
\TeX; few people write in plain \TeX{} anymore.
The current version is \LaTeXe.
\LaTeX{} plays an important \role{} in publishing
scientific articles in Science.

% This is a comment; it will not be shown
% in the final output.
```

LaTeX Output



LaTeX

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$$E = mc^2 \tag{1}$$

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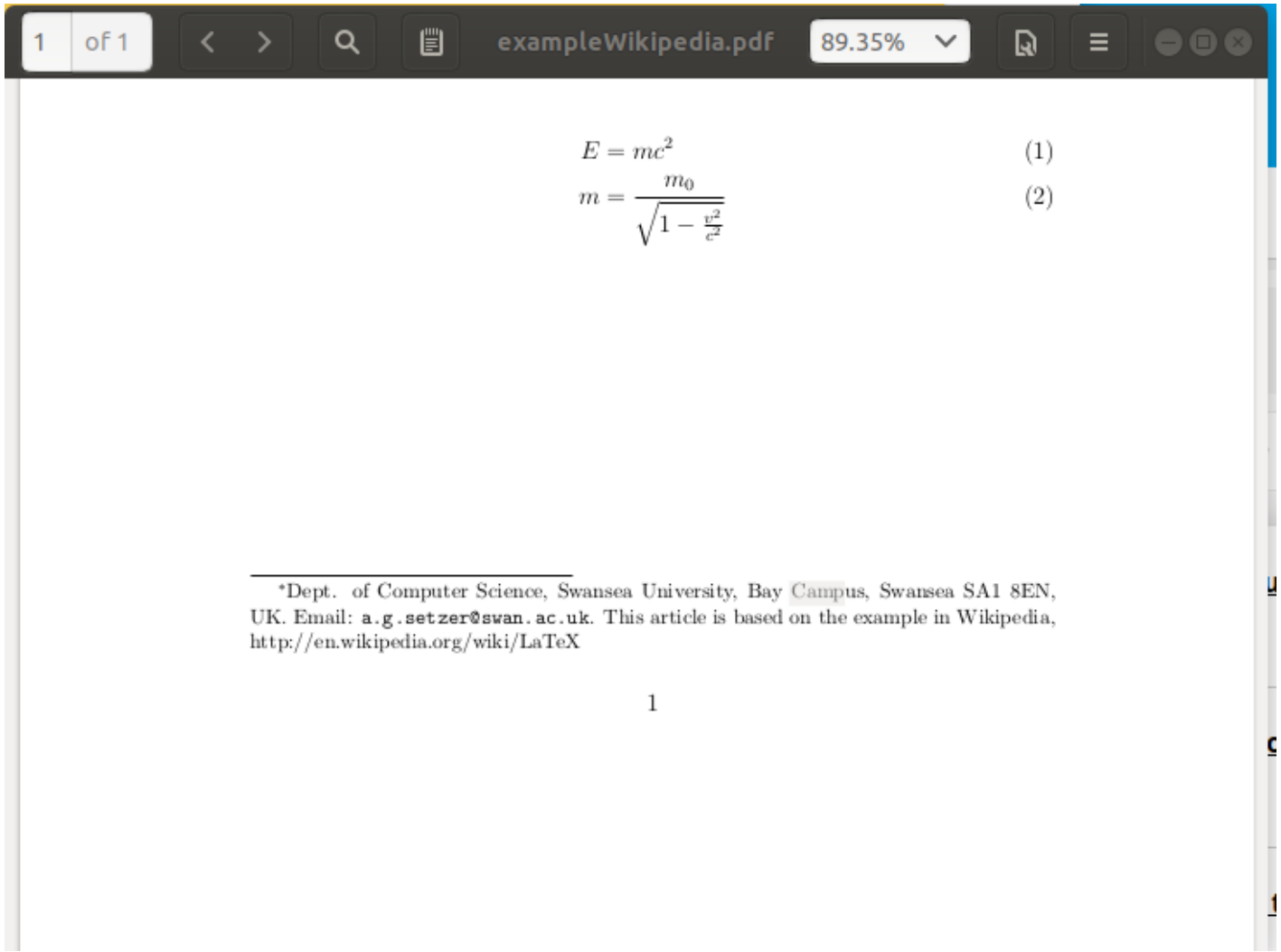
LaTeX Output



Example (Continued)

```
% The following shows a little of the typesetting power
% of LaTeX:

\begin{align}
E &= mc^2    \\
m &= \frac{m_0}{\sqrt{1-\frac{v^2}{c^2}}}
\end{align}
\end{document}
```

LaTeX Output

LaTeX

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7 October 2019

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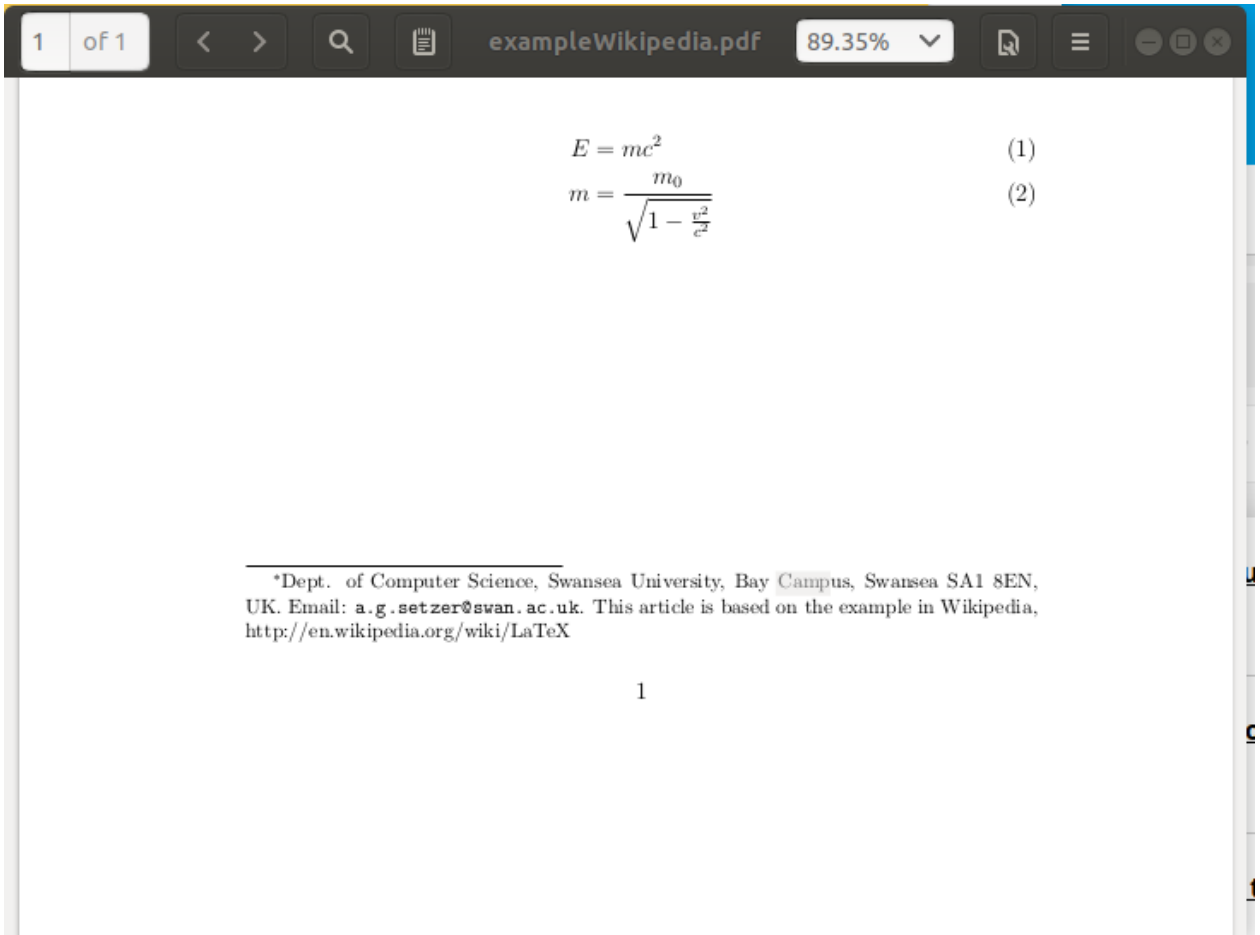
$$E = mc^2 \tag{1}$$

$$m = \frac{m_0}{\sqrt{1 - \frac{v^2}{c^2}}} \tag{2}$$

LaTeX Output



Running LaTeX

```
csetzer@csltas2:~> pdflatex exampleWikipedia.tex
This is pdfTeX, Version 3.14159265-2.6-1.40.18 (TeX Live 20
restricted \write18 enabled.
entering extended mode
(./exampleWikipedia.tex
LaTeX2e <2017-04-15>
Babel <v3.8l> and hyphenation patterns for 84 language(s)
(/usr/share/texlive/texmf-dist/tex/latex/base/article.cls
Document Class:  article 2014/09/29 v1.4h Standard LaTeX do
(/usr/share/texlive/texmf-dist/tex/latex/base/size12.clo))
...  lots of more output ...
Output written on exampleWikipedia.pdf (1 page, 106680 byte
Transcript written on exampleWikipedia.log.
csetzer@csltas2:~> acroread exampleWikipedia.pdf &
```

More Details

- `\documentclass[12pt]{article}`
  - Standard Header of a Latex file.
  - 12pt = font size
  - article = style
    (Article is suitable for reports.
    There are lots of other styles.
    Style "book" is the simplest style for dissertations.
    – There are many more fancy ones.)
- `\usepackage{amsmath}`
  - Loads package amstmath.
  - Rich package for mathematics, here used for command \frac.
  - Lots of packages are available.
- `\title{\LaTeX}`
  - Defines the title.
  - \LaTeX{} is a macro typesetting LaTeX.
- `\author{Anton Setzer`
  - Starts defining the author (note { not closed yet)

More Details

- `\thanks{Dept. of Computer Science,`
  `Swansea University, Bay Campus,`
  `Swansea SA1 8EN, UK.`
  `Email: {\tt a.g.setzer@swan.ac.uk}.`
  `This article is based on the example in`
  `Wikipedia,`
  `http://en.wikipedia.org/wiki/LaTeX}}`
  - Footnote added to author.
  - {\tt ··· } type sets this part in type writer font.
  - Second "}" finishes definition of author.

  `\date{7 October 2019}`
  - Defines the date.

More Details

- `\newcommand{\role}{{r\^{o}le}}`
  - Defines a macro.
  - From now on \role will expand to {r\^{o}le}.
  - Curly brackets will be used to group text but will not be printed.
  - \^{o} typesets ô
  - There are macros for defining lots and lots of special symbols.
  - `http://www.tug.org/tex-archive/info/symbols/comprehensive/`
  - Macros can have parameters as well.

More Details

- `\begin{document}`
  - Start of the content of the document.
- `\maketitle`
  - Puts title, author, date at this position.
  - Without this command no title, author, date will occur in the document.

More Details

- `\LaTeX{} is a document preparation system for the \TeX{} typesetting program. It offers ···`
  - This is standard text to be typeset.
  - Aligning the text done by the system.
  - Line breaks in the text create only space between words.
  - Double line breaks creates a paragraph
    (Equivalently one can use the macro \par).
  - Several blanks, tabs, line breaks are the same as a single space
    (except for double line breaks).
  - \TeX{} typesets TEX.

More Details

- `\LaTeX{} plays an important \role{} in publishing`
  - Here the user defined macro \role{} typeset as rôle is used.
  - {} here makes sure that there is a blank after LaTeXand after rôle.
    Spaces after a macro are ignored.
- `% This is a comment; it will not be shown`
  - Everything in a a line after % is a comment

Example (Continued)

- `\begin{align}`
  ...
  `\end{align}`
  - Example of an environment.
  - There are many environments in LaTeX.

Example (Continued)

- \begin{align}
  ... & ... \\
  ... & ... \\
  \end{align}
  - Environment align typesets several formulae, which are numbered as (1), (2) consecutively.
  - Content of an align environment is mathematical text.
    - LaTeX and TeX have a text mode and a formula mode.
    - In formula mode different macros (usually for creating mathematical text) are used.
    - In mathematical text all blanks are ignored.
    - Mathematical text is where the full power of LaTeX/TeXis shown.
    - Seems to be the easiest system for typesetting formulae.
  - \\ separates lines in mathematical text (can be used for ordinary text as well).
  - Symbols & mark positions to be aligned.

Example (Continued)

- c^2
  - Typesets c^2 in mathematical text.
- *m_0.
  - Typesets m_0 in mathematical text.
- \frac{$\cdots$}{$\cdots$}
  - Type sets a fraction $\frac{\cdots}{\cdots}$.
  - Note that we can nest fractions.
- \sqrt{$\cdots$}
  - Typesets $\sqrt{\cdots}$.
- \end{align}
  - End of align environment.
- \end{document}
  - End of the document.
  - Text after this will be ignored.

LaTeX under Windows

- Use any text editor. Recommended: Emacs or XEmacs.
- MikTeX is a LaTeX compiler for Windows.
- For viewing use any pdf reader.
- See for instance
  http://www.pinteric.com/miktex.html
  on how to use LaTeX under Windows.
- Other onlinetools available e.g. ShareLatex.

BibTeX

- BibTeX allows to create your bibliography automatically from a BibTeX file, in which bibliography entries are listed in a database like syntax.
- Publishers and many authors provide BibTeX entries for many publication.
- Google scholar can be adjusted through settings to provide BibTeX entries - however one usually needs to do some adjustments.

Example BibTeX entry

```
@book{kopka2003guide,
      title={Guide to {L}a{T}a{X}},
      author={Kopka, H. and Daly, P.W.},
      edition={4},
      year={2003},
      publisher={Addison-Wesley}
}
```

Example BibTeX entry

- We wrote {L}a{T}a{X}, because BibTeX puts by default everything in lowercase in titles, except for the first character. By using {L} one forces L to be taken as a capital letter.
- Many more fields available, many are optional.
- Fields vary depending on the type.
  - Here type is book as indicated by @book.
  - Examples of types are article, misc, unpublished, inproceedings, proceedings, PhDthesis, and many more.
- This item can now be cited using \cite{kopka2003guide}.
- BibTeX entries are stored in a file with extension .bib
- The bibliography is incorporated into your LaTeX document by using the commands:
  \bibliographystyle{abbrvnat}
  \bibliography{bibtexfilename}
  - There are many different bibliographystyles available.
  - bibtexfilename is the name of your BibTeX file.

Some Books

- Helmut Kopka, Partrick W. Daly: Guide to LaTeX (Tools and Techniques for Computer Type Settings. Addison-Wesley 4th edition, 2003.
- Leslie Lamport: LaTeX: A document preparation system. User's guide and Reference manual. Addison Wesley, 1994.
- Frank Mittelbach, Michel Goossens: The Latex companion. Addison Wesley, 2nd Edition, 2004.
- Michel Goossens, Frank Mittelbach: The Latex Graphics companion. Addison Wesley, 2nd Edition, 2007.

More Documentation

- Lots of documentation on LaTeX (tutorials, user guides etc) available online.
- Links available on the module home page at http://www.cs.swan.ac.uk/~csetzer/lectures/computerScienceProjectResearchMethods/current/index.html