

# DocOnce Quick Reference

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Jun 14, 2016

## Contents

0.1	Supported Formats . . . . .	1
0.2	Emacs syntax support . . . . .	2
0.3	Title, Authors, and Date . . . . .	3
0.4	Copyright . . . . .	3
0.5	Section Types . . . . .	4
0.6	Inline Formatting . . . . .	4
0.7	Lists . . . . .	5
0.8	Comment lines . . . . .	7
0.9	Inline comments . . . . .	7
0.10	Verbatim/Computer Code . . . . .	8
0.11	$\LaTeX$ Mathematics . . . . .	10
0.12	Writing Guidelines (Especially for $\LaTeX$ Users!) . . . . .	11
0.13	Hyperlinks . . . . .	14
0.14	Figures and Movies . . . . .	15
0.15	Tables . . . . .	16
0.16	Labels and References . . . . .	17
0.17	Citations and Bibliography . . . . .	17
0.18	Generalized References . . . . .	18
0.19	Index of Keywords . . . . .	18
0.20	Capabilities of The Program <code>doconce</code> . . . . .	19
0.21	Exercises . . . . .	21
0.22	Environments . . . . .	23
0.23	Preprocessing . . . . .	24
0.24	Resources . . . . .	25

**WARNING:** This quick reference is very incomplete!

**Mission.** Enable writing documentation with much mathematics and computer code *once, in one place* and include it in traditional  $\text{\LaTeX}$  books, thesis, and reports, and without extra efforts also make professionally looking web versions with Sphinx or HTML. Other outlets include Google's `blogger.com`, Wikipedia/Wikibooks, IPython notebooks, plus a wide variety of other formats for documents without mathematics and code.

## 0.1 Supported Formats

DocOnce currently translates files to the following formats:

- $\text{\LaTeX}$  (format `latex` or `pdflatex`)
- HTML (format `html`)
- Sphinx (format `sphinx`)
- Pandoc-extended or GitHub-flavored Markdown (format `pandoc`)
- IPython notebook (format `ipynb`)
- Matlab notebook (format `matlabnb`)
- MediaWiki (format `mwiki`)
- Googlecode wiki (format `gwiki`)
- Creoloe wiki (format `cwiki`)
- reStructuredText (format `rst`)
- plain (untagged) ASCII (format `plain`)
- Epydoc (format `epydoc`)
- StructuredText (format `st`)

For documents with much code and mathematics, the best (and most supported) formats are `latex`, `pdflatex`, `sphinx`, and `html`; and to a slightly less extent `mwiki` and `pandoc`. The HTML format supports blog posts on Google and Wordpress.

### Use a text editor with monospace font!

Some DocOnce constructions are sensitive to whitespace, so you *must* use a text editor with monospace font.

## 0.2 Emacs syntax support

The file `.doconce-mode.el` in the DocOnce source distribution gives a "DocOnce Editing Mode" in Emacs. Store the raw version of the file in the home directory and add `(load-file " /doconce-mode.el")` to the `.emacs` file.

Besides syntax highlighting of DocOnce documents, this Emacs mode provides a lot of shortcuts for setting up many elements in a document:

Emacs key	Action
Ctrl+c f	figure
Ctrl+c v	movie/video
Ctrl+c h1	heading level 1 (section/h1)
Ctrl+c h2	heading level 2 (subsection/h2)
Ctrl+c h3	heading level 2 (subsection/h3)
Ctrl+c hp	heading for paragraph
Ctrl+c me	math environment: !bt equation !et
Ctrl+c ma	math environment: !bt align !et
Ctrl+c ce	code environment: !bc code !ec
Ctrl+c cf	code from file: @@@CODE
Ctrl+c table2	table with 2 columns
Ctrl+c table3	table with 3 columns
Ctrl+c table4	table with 4 columns
Ctrl+c exer	exercise outline
Ctrl+c slide	slide outline
Ctrl+c help	print this table

## 0.3 Title, Authors, and Date

A typical example of giving a title, a set of authors, a date, and an optional table of contents reads

```
TITLE: On an Ultimate Markup Language
AUTHOR: H. P. Langtangen at Center for Biomedical Computing, Simula Research Laboratory & Dept. of Informatics
AUTHOR: Kaare Dump Email: dump@cyb.space.com at Segfault, Cyberspace Inc.
AUTHOR: A. Dummy Author
DATE: today
TOC: on
```

The entire title must appear on a single line. The author syntax is

```
name Email: somename@adr.net at institution1 & institution2
```

where the email is optional, the "at" keyword is required if one or more institutions are to be specified, and the & keyword separates the institutions (the keyword and works too). Each author specification must appear on a single line. When more than one author belong to the same institution, make sure that the institution is specified in an identical way for each author.

The date can be set as any text different from `today` if not the current date is wanted, e.g., Feb 22, 2016.

The table of contents is removed by writing `TOC: off`.

## 0.4 Copyright

Copyright for selected authors and/or institutions are easy to insert as part of the AUTHOR command. The copyright syntax is

```
{copyright,year1-year2|license}
```

and can be placed after the author or after an institution, e.g.,

```
AUTHOR: name Email: somename@adr.net {copyright,2006-present} at inst1  
AUTHOR: name {copyright} at inst1 {copyright}
```

The first line gives name a copyright for 2006 up to the present year, while the second line gives copyright to name and the institution inst1 for the present year. The license can be any formulation, but there are some convenient abbreviations for Creative Commons (“public domain”) licenses: CC BY for Creative Commons Attribution 4.0 license, CC BY-NC for Creative Commons Attribution-NonCommercial 4.0 license. For example,

```
AUTHOR: name1 {copyright|CC BY} at institution1  
AUTHOR: name2 {copyright|CC BY} at institution2
```

is a very common copyright for the present year with the Attribution license. The copyright must be identical for all authors and institutions.

## 0.5 Section Types

Section type	Syntax
chapter	===== Heading ===== (9 =)
section	===== Heading ===== (7 =)
subsection	===== Heading ===== (5 =)
subsubsection	==== Heading ==== (3 =)
paragraph	__Heading.__ (2 _)
abstract	__Abstract.__ Running text...
appendix	===== Appendix: heading ===== (7 =)
appendix	===== Appendix: heading ===== (5 =)
exercise	===== Exercise: heading ===== (7 =)
exercise	===== Exercise: heading ===== (5 =)

Note that abstracts are recognized by starting with \_\_Abstract.\_\_ or \_\_Summary.\_\_ at the beginning of a line and ending with three or more = signs of the next heading.

The Exercise: keyword can be substituted by Problem: or Project:. A recommended convention is that an exercise is tied to the text, a problem can stand on its own, and a project is a comprehensive problem.

## 0.6 Inline Formatting

Words surrounded by `*` are emphasized: `*emphasized words*` becomes *emphasized words*. Similarly, an underscore surrounds words that appear in boldface: `_boldface_` becomes **boldface**. Colored words are also possible: the text

```
'color{red}{two red words}'
```

becomes **two red words**.

Quotations appear inside double backticks and double single quotes:

This is a sentence with ‘words to be quoted’.

A forced linebreak is specified by `<linebreak>` at the point where the linebreak in the output is wanted.

Footnotes use a label in the text with the footnote text separate, preferably after the paragraph where the footnote appears:

Differentiating<sup>[^diff2]</sup> (ref<sup>{eq1}</sup>) leads  
to a new and simpler equation.

<sup>[^diff2]</sup>: More precisely, we apply the divergence  
 $\nabla \cdot$  on both sides.

Here comes a new paragraph...

Non-breaking space is inserted using the tilde character as in  $\text{\LaTeX}$ :

This distance corresponds to 7.5~km, which is traveled in \$7.5/5\$~s.

A horizontal rule for separating content vertically, like this:

is typeset as four or more hyphens on a single line:

-----

The `latex`, `pdflatex`, `sphinx`, and `html` formats support em-dash, indicated by three hyphens: `--`. Here is an example:

The em-dash is used - without spaces - as alternative to hyphen with space around in sentences---this way, or in quotes:  
*\*Premature optimization is the root of all evil.\*--- Donald Knuth.*

This text is in the `pdflatex` rendered as

The em-dash is used - without spaces - as alternative to hyphen with space around in sentences—this way, or in quotes: *Premature optimization is the root of all evil.*— Donald Knuth.

An ampersand, as in Guns & Roses or, Texas A & M, is written as a plain & with space(s) on both sides. Single upper case letters on each side of &, as in Texas A & M, remove the spaces and result in, Texas A & M, while words on both sides of &, as in Guns & Roses, preserve the spaces: Guns & Roses.

Failing to have spaces before and after & will result in wrong typesetting of the ampersand in the `html`, `latex`, and `pdflatex` formats.

Emojis, as defined in <http://www.emoji-cheat-sheet.com>, can be inserted in the text, as (e.g.) `:dizzy_face:` with blank or newline before or after. Only the `pdflatex` and `html` output formats translate emoji specifications to images, while all other formats leave the textual specification in the document. The command-line option `--no_emoji` removes all emojis from the output document.

## 0.7 Lists

There are three types of lists: *bullet lists*, where each item starts with `*`, *enumeration lists*, where each item starts with `o` and gets consecutive numbers, and *description lists*, where each item starts with `-` followed by a keyword and a colon.

Here is a bullet list:

```
* item1
* item2
  * subitem1 of item2
  * subitem2 of item2,
    second line of subitem2
* item3
```

Note that sublists are consistently indented by one or more blanks as shown: bullets must exactly match and continuation lines must start right below the line above.

Here is an enumeration list:

```
o item1
o item2
  may appear on
  multiple lines
  o subitem1 of item2
  o subitem2 of item2
o item3
```

And finally a description list:

```
- keyword1: followed by
  some text
  over multiple
  lines
- keyword2:
  followed by text on the next line
- keyword3: and its description may fit on one line
```

The code above follows.

Here is a bullet list:

- item1
- item2
  - subitem1 of item2

- subitem2 of item2
- item3

Note that sublists are consistently indented by one or more blanks as shown: bullets must exactly match and continuation lines must start right below the line above.

Here is an enumeration list:

1. item1
2. item2 may appear on multiple lines
  - (a) subitem1 of item2
  - (b) subitem2 of item2
3. item3

And finally a description list:

**keyword1:** followed by some text over multiple lines

**keyword2:** followed by text on the next line

**keyword3:** and its description may fit on one line

#### No indentation - except in lists!

DocOnce syntax is sensitive to whitespace. No lines should be indented, only lines belonging to lists. Indented lines may give strange output in some formats.

## 0.8 Comment lines

Lines starting with # are treated as comments in the document and translated to the proper syntax for comments in the output document. Such comment lines should not appear before  $\LaTeX$  math blocks, verbatim code blocks, or lists if the formats `rst` and `sphinx` are desired.

Comment lines starting with ## are not propagated to the output document and can be used for comments that are only of interest in the DocOnce file.

Large portions of text can be left out using Preprocess. Just place # `#ifdef EXTRA` and # `#endif` around the text. The command line option `-DEXTRA` will bring the text alive again.

When using the Mako preprocessor one can also place comments in the DocOnce source file that will be removed by Mako before DocOnce starts processing the file.

## 0.9 Inline comments

Inline comments meant as messages or notes, to authors during development in particular, are enabled by the syntax

```
[name: running text]
```

where `name` is the name or ID of an author or reader making the comment, and `running text` is the comment. The name can contain upper and lower case characters, digits, single quote, + and -, as well as space. Here goes an example.

```
Some running text. [hpl: There must be a space after the colon,  
but the running text can occupy multiple lines.]
```

which is rendered as

Some running text. **hpl 1:** There must be a space after the colon,  
but the running text can occupy multiple lines.

The inline comments have simple typesetting in most formats, typically boldface name, a comment number, with everything surrounded by parenthesis. However, with  $\text{\LaTeX}$  output and the `--latex_todonotes` option to `doconce` format, colorful margin or inline boxes (using the `todonotes` package) make it very easy to spot the comments.

Running

```
doconce format html mydoc.do.txt --skip_inline_comments
```

removes all inline comments from the output. This feature makes it easy to turn on and off notes to authors during the development of the document.

All inline comments to readers can also be physically removed from the DocOnce source by

```
doconce remove_inline_comments mydoc.do.txt
```

Inline comments can also be used to markup edits. There are add, delete, and replacement comments for editing:

```
[add: ,]  
[add: .]  
[add: ;]  
[del: ,]  
[del: .]  
[del: ;]  
[add: some text]  
[del: some text]  
[edit: some text -> some replacement for text]  
[name: some text -> some replacement for text]
```

For example, the text

```
First consider a quantity  $QQ$ . Without loss of generality, we assume  
 $QQ>0$ . There are three, fundamental, basic property of  $QQ$ .
```



can be edited as

```
First[add: ,] consider [edit: a quantity -> the flux]
[del: $$$. Without loss of generality,
we assume]  $Q > 0$ . There are three[del: ,] fundamental[del: , basic]
[edit: property -> properties] of  $Q$ . [add: These are not
important for the following discussion.]
```

which in the pdf<sub>l</sub>atex output format results in

First, **(edit 2: add comma)** consider **(edit 3:) a-quantity the flux (edit 4:)  $Q$ . Without loss of generality, we assume  $Q > 0$ .** There are three **(edit 5: delete comma)** fundamental**(edit 6:) ,basic (edit 7:) property properties** of  $Q$ . **(edit 8:) These are not important for the following discussion.**

To implement these edits, run

```
Terminal> doconce apply_edit_comments mydoc.do.txt
```

## 0.10 Verbatim/Computer Code

Inline verbatim code is typeset within back-ticks, as in

```
Some sentence with 'words in verbatim style'.
```

resulting in Some sentence with words in verbatim style.

Multi-line blocks of verbatim text, typically computer code, is typeset in between `!bc xxx` and `!ec` directives, which must appear on the beginning of the line. A specification `xxx` indicates what verbatim formatting style that is to be used. Typical values for `xxx` are `nothing`, `cod` for a code snippet, `pro` for a complete program, `sys` for a terminal session, `dat` for a data file (or output from a program), `Xpro` or `Xcod` for a program or code snippet, respectively, in programming `X`, where `X` may be `py` for Python, `cy` for Cython, `sh` for Bash or other Unix shells, `f` for Fortran, `c` for C, `cpp` for C++, `m` for MATLAB, `p1` for Perl. For output in latex one can let `xxx` reflect any defined verbatim environment in the `ptex2tex` configuration file (`.ptex2tex.cfg`). For sphinx output one can insert a comment

```
# sphinx code-blocks: pycod=python cod=fortran cppcod=c++ sys=console
```

that maps environments (`xxx`) onto valid language types for Pygments (which is what sphinx applies to typeset computer code).

The `xxx` specifier has only effect for latex and sphinx output. All other formats use a fixed monospace font for all kinds of verbatim output.

Here is an example of computer code (see the source of this document for exact syntax):

```
from numpy import sin, cos, exp, pi

def f(x, y, z, t):
    return exp(-t)*sin(pi*x)*sin(pi*y)*cos(2*pi*z)
```

Computer code can also be copied from a file:

```
@@@CODE doconce_program.sh
@@@CODE doconce_program.sh fromto: doconce clean~doconce split_rst
@@@CODE doconce_program.sh from-to: doconce clean~doconce split_rst
@@@CODE doconce_program.sh envir=shpro fromto: name=@
```

The @@@CODE identifier must appear at the very beginning of the line. The first line copies the complete file `doconce_program.sh`. The second line copies from the first line matching the *regular expression* `doconce clean` up to, but not including, the line matching the *regular expression* `~doconce split_rst`. The third line behaves as the second, but the line matching the first regular expression is not copied (this construction often used for copying text between begin-end comment pair in the file).

The copied lines from file are in this example put inside `!bc shpro` and `!ec` directives, if a complete file is copied, while the directives become `!bc shcod` and `!ec` when a code snippet is copied from file. In general, for a filename extension `.X`, the environment becomes `!bc Xpro` or `!bc Xcod` for a complete program or snippet, respectively. The environments (`Xcod` and `Xpro`) are only active for `latex`, `pdflatex`, `html`, and `sphinx` output. The fourth line above specifies the code environment explicitly (`envir=shpro`) such that it indicates a complete shell program (`shpro`) even if we copy a part of the file (here from `name=` until the end of the file). Copying a part will by default lead to `!bc shcod`, which indicates a code snippet that normally needs more code to run properly.

The `--code_prefix=text` option adds a path `text` to the filename specified in the @@@CODE command (URLs work). For example

```
@@@CODE src/myfile.py
```

and `--code_prefix=http://some.place.net`, the file

```
http://some.place.net/src/myfile.py
```

will be included. If source files have a header with author, email, etc., one can remove this header by the option `'--code_skip_until=# ---`. The lines up to and including (the first) `# ---` will then be excluded.

Important warnings:

- A code block must come after some plain sentence (at least for successful output in `reStructuredText`), not directly after a section/paragraph heading, table, comment, figure, or movie.
- Verbatim code blocks inside lists can be ugly typeset in some output formats. A more robust approach is to replace the list by paragraphs with headings.

## 0.11 L<sup>A</sup>T<sub>E</sub>X Mathematics

DocOnce supports inline mathematics and blocks of mathematics, using standard L<sup>A</sup>T<sub>E</sub>X syntax. The output formats `html`, `sphinx`, `latex`, `pdflatex`, `pandoc`, and `mwiki` work with this syntax while all other formats will just display the raw L<sup>A</sup>T<sub>E</sub>X code.

Inline expressions are written in the standard L<sup>A</sup>T<sub>E</sub>X way with the mathematics surrounded by dollar signs, as in  $Ax = b$ . To help increase readability in other formats than `sphinx`, `latex`, and `pdflatex`, inline mathematics may have a more human readable companion expression. The syntax is like

```
 $\sin(\|\mathbf{u}\|)$ 
```

That is, the L<sup>A</sup>T<sub>E</sub>X expression appears to the left of a vertical bar (pipe symbol) and the more readable expression appears to the right. Both expressions are surrounded by dollar signs.

Blocks of L<sup>A</sup>T<sub>E</sub>X mathematics are written within `!bt` and `!et` (begin/end TeX) directives starting on the beginning of a line:

```
!bt
\begin{align*}
\nabla\cdot\mathbf{u} &= 0, \\
\nabla\times\mathbf{u} &= 0.
\end{align*}
!et
```

This L<sup>A</sup>T<sub>E</sub>X code gets rendered as

$$\begin{aligned}\nabla \cdot \mathbf{u} &= 0, \\ \nabla \times \mathbf{u} &= 0.\end{aligned}$$

Here is a single equation:

```
!bt
\[\frac{\partial\mathbf{u}}{\partial t} + \mathbf{u}\cdot\nabla\mathbf{u} = 0.\]
!et
```

which results in

$$\frac{\partial \mathbf{u}}{\partial t} + \mathbf{u} \cdot \nabla \mathbf{u} = 0.$$

**LaTeX Newcommands.** The author can define `newcommand` statements in files with names `newcommands*.tex`. Such commands should only be used for mathematics (other L<sup>A</sup>T<sub>E</sub>X constructions are only understood by L<sup>A</sup>T<sub>E</sub>X itself). The convention is that `newcommands_keep.tex` contains the newcommands that are kept in the document, while those in `newcommands_replace.tex` will be replaced by their full L<sup>A</sup>T<sub>E</sub>X code. This convention helps make readable documents in formats without L<sup>A</sup>T<sub>E</sub>X support. For `html`, `sphinx`, `latex`, `pdflatex`, `mwiki`, `ipynb`, and `pandoc`, the mathematics in newcommands is rendered

nicely anyway. If you desire `newcommand` outside  $\text{\LaTeX}$  mathematics, simply use a Mako variable or a Mako function (which will be much more flexible and powerful).

## 0.12 Writing Guidelines (Especially for $\text{\LaTeX}$ Users!)

$\text{\LaTeX}$  writers often have their own writing habits with use of their own favorite  $\text{\LaTeX}$  packages. DocOnce is a much simpler format and corresponds to writing in quite plain  $\text{\LaTeX}$  and making the ascii text look nice (be careful with the use of white space!). This means that although DocOnce has borrowed a lot from  $\text{\LaTeX}$ , there are a few points  $\text{\LaTeX}$  writers should pay attention to. Experience shows that these points are so important that we list them *before* we list typical DocOnce syntax!

Any  $\text{\LaTeX}$  syntax in mathematical formulas is accepted when DocOnce translates the text to  $\text{\LaTeX}$ , but if output in the `sphinx`, `pandoc`, `mwiki`, `html`, or `ipynb` formats is also important, one should follow the rules below.

- AMS  $\text{\LaTeX}$  mathematics is supported, also for the `html`, `sphinx`, and `ipynb` formats.
- If you want  $\text{\LaTeX}$  math blocks to work with `latex`, `html`, `sphinx`, `markdown`, and `ipynb`, it is recommended to use only the following equation environments: `\[ ... \]`, `equation*`, `equation`, `align*`, `align`. `alignat*`, `alignat`. Other environments, such as `split`, `multiline`, `gather` are supported in modern MathJax in HTML and Sphinx, but may face rendering problems (to a larger extent than `equation` and `align`). DocOnce performs extensions to `sphinx`, `ipynb`, and other formats such that labels in `align` and `alignat` environments work well. If you face problems with fancy  $\text{\LaTeX}$  equation environments in web formats, try rewriting with plain `align`, `nonumber`, etc.
- Do not use comments inside equations.
- Newcommands in mathematical formulas are allowed, but not in the running text. Newcommands must be defined in files with names `newcommands*.tex`. Use `\newcommand` and not `\def`. Each newcommand must be defined on a single line. Use Mako functions if you need macros in the running text.
- Use labels and refer to them for sections, figures, movies, and equations only. MediaWiki (`mwiki`) does not support references to equations.
- Spaces are not allowed in labels.
- There is just one `ref` command (no `\eqref` for equations) and references to equations must use parentheses. Never use the tilde (non-breaking space) character before references to figures, sections, etc., but tilde is allowed for references to equations.

- Never use `\pageref` as pages are not a concept in web documents (there is only a `ref` command in DocOnce and it refers to labels).
- Only figures and movies are floating elements in DocOnce, all other elements (code, tables, algorithms) must appear *inline* without numbers or labels for reference<sup>1</sup> (refer to inline elements by a section label). The reason is that floating elements are in general not used in web documents, but we made an exception with figures and movies.
- Keep figure captions short as they are used as references in the Sphinx format. Avoid inline mathematics since Sphinx will strip it away in the figure reference. (Many writing styles encourage rich captions that explain everything about the figure, but this will work well only in the HTML and  $\LaTeX$  formats.)
- You cannot use `subfigure` to combine several image files in one figure, but you can combine the files to one file using the `doconce combine_images` tool. Refer to individual image files in the caption or text by (e.g.) “left” and “right”, or “upper left”, “lower right”, etc.
- Footnotes can be used as usual in  $\LaTeX$ , but some HTML formats are not able to display mathematics or inline verbatim or other formatted code (emphasis, boldface, color) in footnotes - have that in mind.
- Use plain `cite` for references (e.g., `\citeauthor` has no counterpart in DocOnce). The bibliography must be prepared in the Publish format, but import from (clean)  $\BibTeX$  is possible.
- Use `idx` for index entries, but put the definitions between paragraphs, not inside them (required by Sphinx).
- Use the `\bm` command (from the `bm` package, always included by DocOnce) for boldface in mathematics.
- Make sure all ordinary text starts in column 1 on each line. Equations can be indented. The `\begin{}` and `\end{}` directives should start in column 1.
- If you depend on various  $\LaTeX$  environments for your writings, you have to give up these, or implement *user-defined environments* in DocOnce. For instance, examples are normally typeset as subsections in DocOnce, but can also utilize a user-defined example environment. Learn about the exercise support in DocOnce for typesetting exercises, problems, and projects.

---

<sup>1</sup>There is an exception: by using *user-defined environments* within `!bu-name` and `!eu-name` directives, it is possible to label any type of text and refer to it. For example, one can have environments for examples, tables, code snippets, theorems, lemmas, etc. One can also use Mako functions to implement environments.

- Learn about the preprocessors Preprocess and Mako - these are smart tools for, e.g., commenting out/in large portions of text and creating macros.
- Use *generalized referenes* when referring to companion documents that may later become part of this document (or migrated out of this document).
- Follow [recommendations for DocOnce books](#) if you plan to write a book.

#### Use the preprocessor to tailor output.

If you really need special  $\LaTeX$  constructs in the  $\LaTeX$  output from DocOnce, you may use use preprocessor if-tests on the format (typically `#if FORMAT in ("latex", "pdflatex")`) to include such special  $\LaTeX$  code. With an else clause you can easily create corresponding constructions for other formats. This way of using Preprocess or Mako allows advanced  $\LaTeX$  features, or HTML features for the HTML formats, and thereby fine tuning of the resulting document. More tuning can be done by automatic editing of the output file (e.g., `.tex` or `.html`) produced by DocOnce using your own scripts or the `doonce replace` and `doonce subst` commands.

#### Autotranslation of $\LaTeX$ to DocOnce?

The tool `doonce latex2doonce` may help you translating  $\LaTeX$  files to DocOnce syntax. However, if you use computer code in floating list environments, special packages for typesetting algorithms, example environments, `subfigure` in figures, or a lot of newcommands in the running text, there will be need for a lot of manual edits and adjustments.

For examples, figure environments can be translated by the program `doonce latex2doonce` only if the label is inside the caption and the figure is typeset like

```
\begin{figure}
  \centering
  \includegraphics[width=0.55\linewidth]{figs/myfig.pdf}
  \caption{This is a figure. \label{myfig}}
\end{figure}
```

If the  $\LaTeX$  is consistent with respect to placement of the label, a simple script can autoedit the label inside the caption, but many  $\LaTeX$  writers put the label at different places in different figures, and then it becomes more difficult to autoedit figures and translate them to the DocOnce `FIGURE:` syntax.

Tables are hard to interpret and translate, because the headings and caption can be typeset in many different ways. The type of table that is recognized looks like

```
\begin{table}
\caption{Here goes the caption.}
\begin{tabular}{lr}
\hline
\multicolumn{1}{c}{ $v_0$ } & \multicolumn{1}{c}{ $f_R(v_0)$ }\hline
1.2 & 4.2\1.1 & 4.0\0.9 & 3.7
\hline
\end{tabular}
\end{table}
```

Recall that table captions do not make sense in DocOnce since tables must be inlined and explained in the surrounding text.

Footnotes are also problematic for `doconce latex2doconce` since DocOnce footnotes must have the explanation outside the paragraph where the footnote is used. This calls for manual work. The translator from  $\text{\LaTeX}$  to DocOnce will insert `_PROBLEM_` and mark footnotes. One solution is to avoid footnotes in the  $\text{\LaTeX}$  document if fully automatic translation is desired.

## 0.13 Hyperlinks

Links use either a link text or the raw URL:

```
Here is some "some link text": "http://some.net/address"
(as in "search google": "http://google.com")
or just the raw address: URL: "http://google.com".
```

```
Links to files typeset in verbatim mode applies backtics:
"myfile.py": "http://some.net/some/place/myfile.py".
```

```
Mail addresses works too: send problems to
"hpl@simula.no": "mailto:hpl@simula.no"
or just "send mail": "mailto:hpl@simula.no".
```

## 0.14 Figures and Movies

Figures and movies have almost equal syntax:

```
FIGURE: [relative/path/to/figurefile, width=500 frac=0.8] Here goes the caption which must be on a s
```

```
MOVIE: [relative/path/to/moviefile, width=500] Here goes the caption which must be on a single line.
```

Note three important syntax details:

1. A mandatory comma after the figure/movie filename,
2. no comments between width, height, and frac and no spaces around the = characters,

3. all of the command must appear on a single line,
4. there must be a blank line after the command.

The figure file can be listed without extension. DocOnce will then find the version of the file with the most appropriate extension for the chosen output format. If not suitable version is found, DocOnce will convert another format to the needed one.

The caption is optional. If omitted, the figure will be inlined (meaning no use of any figure environment in HTML or  $\LaTeX$  formats). The `width` and `height` parameters affect HTML formats (`html`, `rst`, `sphinx`), while `frac` is the width of the image as a fraction of the total text width in the `latex` and `pdflatex` formats.

The command-line options `--fig_prefix=...` and `--mov_prefix=...` can be used to add a path (can be a URL) to all figure and movie files, respectively. This is useful when including DocOnce documents in other DocOnce documents such that the text is compiled in different directories (with different paths to the figure directory).

Movie files can either be a video or a wildcard expression for a series of frames. In the latter case, a simple device in an HTML page will display the individual frame files as a movie.

Combining several image files into one can be done by the

```
doconce combine_images image1 image2 ... output_image
```

This command applies `montage` or PDF-based tools to combine the images to get the highest quality.

YouTube and Vimeo movies will be embedded in `html` and `sphinx` documents and otherwise be represented by a link. The syntax is

```
MOVIE: [http://www.youtube.com/watch?v=_07iUiftbKU, width=420 height=315] YouTube movie.
```

```
MOVIE: [http://vimeo.com/55562330, width=500 height=278] Vimeo movie.
```

The latter results in

<http://vimeo.com/55562330>

Movie 1: Vimeo movie.

## 0.15 Tables

The table in Section 0.5 was written with this syntax:

Section type	Syntax
chapter	'===== Heading =====' (9 '=')
section	'===== Heading =====' (7 '=')



subsection	'==== Heading ====='	(5 '=' )	
subsubsection	'=== Heading ==='	(3 '=' )	
paragraph	'___Heading.___'	(2 '=' )	
-----			

Note that

- Each line begins and ends with a vertical bar (pipe symbol).
- Column data are separated by a vertical bar (pipe symbol).
- There must be a blank line before and after the table.
- There may be horizontal rules, i.e., lines with dashes for indicating the heading and the end of the table, and these may contain characters 'c', 'l', or 'r' for how to align headings or columns. The first horizontal rule may indicate how to align headings (center, left, right), and the horizontal rule after the heading line may indicate how to align the data in the columns (center, left, right). One can also use X for potentially very wide text that must be wrapped and left-adjusted (will only affect `latex` and `pdflatex` where the `tabularx` package is then used; X means l in all other formats).
- If the horizontal rules are without alignment information there should be no vertical bar (pipe symbol) between the columns. Otherwise, such a bar indicates a vertical bar between columns in  $\text{\LaTeX}$ .
- Many output formats are so primitive that heading and column alignment have no effect.

A quick way of generating tables is to place all the entries in a file with comma as separator (a CSV file) and then run the utility `doonce csv2table` to create a table in the DocOnce format.

The command-line option `-tables2csv` (to `doonce` format) makes DocOnce dump each table to CSV format in a file `table_X.csv`, where X is the table number. This feature makes it easy to load tables into spreadsheet programs for further analysis.

DocOnce tables can be efficiently made directly from data in CSV files.

```
Terminal> doonce csv2table mydata.csv > mydata_table.do.txt
```

Now we can do `# #include "mydata_table.do.txt"` in the DocOnce source file or simply copy the table in `mydata_table.do.txt` into the DocOnce file.

## 0.16 Labels and References

The notion of labels and references (as well as bibliography and index) is adopted from  $\text{\LaTeX}$  with a very similar syntax. As in  $\text{\LaTeX}$ , a label can be inserted anywhere, using the syntax

```
label{name}
```

with no backslash preceding the label keyword. It is common practice to choose name as some hierarchical name, using a delimiter like : or \_ between (e.g.) section, subsection, and topic.

A reference to the label name is written as

```
ref{name}
```

again with no backslash before ref.

Use labels for sections and equations only, and precede the reference by "Section" or "Chapter", or in case of an equation, surround the reference by parenthesis.

## 0.17 Citations and Bibliography

Single citations are written as

```
cite{name}
```

where name is a logical name of the reference (again,  $\text{\LaTeX}$  writers must not insert a backslash). Bibliography citations often have name on the form Author1\_Author2\_YYYY, Author\_YYYY, or Author1\_etal\_YYYY, where YYYY is the year of the publication. Multiple citations at once is possible by separating the logical names by comma:

```
cite{name1,name2,name3}
```

The bibliography is specified by a line `BIBFILE: papers.pub`, where `papers.pub` is a publication database in the [Publish](#) format.  $\text{\LaTeX}$  .bib files can easily be combined to a Publish database (which DocOnce needs to create bibliographies in other formats than  $\text{\LaTeX}$ ).

## 0.18 Generalized References

There is a *generalized referencing* feature in DocOnce that allows a reference with ref to have one formulation if the label is in the same document and another formulation if the reference is to an item in an external document. This construction makes it easy to work with many small, independent documents in parallel with a book assembly of some of the small elements. The syntax of a generalized reference is

```
ref[internal][cite][external]
```

with a specific example being

```
As explained in
ref[Section ref{subsec:ex}][in cite{testdoc:12}][a "section":
"testdoc.html#_sec2" in the document
"A Document for Testing DocOnce": "testdoc.html" cite{testdoc:12}],
DocOnce documents may include movies.
```

The output from a generalized reference is the text `internal` if all references with `ref` in the text `internal` are references to labels defined in the present document. Otherwise, if `cite` is non-empty and the format is `latex` or `pdflatex`, one assumes that the references in `internal` are to external documents declared by a comment line `# Externaldocuments: testdoc, mydoc` (usually after the title, authors, and date). In this case the output text is `internal` followed by `cite`, and the  $\text{\LaTeX}$  package `xr` is used to handle the labels in the external documents. If none of the two situations above applies, the `external` text will be the output.

## 0.19 Index of Keywords

DocOnce supports creating an index of keywords. A certain keyword is registered for the index by a syntax like (no backslash!)

```
index{name}
```

It is recommended to place any index of this type outside running text, i.e., after (sub)section titles and in the space between paragraphs. Index specifications placed right before paragraphs also gives the `doconce` source code an indication of the content in the forthcoming text. The index is only produced for the `latex`, `pdflatex`, `rst`, and `sphinx` formats.

## 0.20 Capabilities of The Program `doconce`

The `doconce` program can be used for a number of purposes besides transforming a `.do.txt` file to some format. Here is the list of capabilities:

```
DocOnce version 1.3
Usage: doconce command [optional arguments]
commands: format help sphinx_dir subst replace replace_from_file clean lightclean spellcheck find pt

# transform doconce file to another format
doconce format html|latex|pdflatex|rst|sphinx|plain|gwiki|mwiki|cwiki|pandoc|st|epytex dofile

# substitute a phrase by another using regular expressions
doconce subst [-s -m -x --restore] regex-pattern regex-replacement file1 file2 ...
(-s is the re.DOTALL modifier, -m is the re.MULTILINE modifier,
 -x is the re.VERBOSE modifier, --restore copies backup files back again)

# replace a phrase by another literally
doconce replace from-text to-text file1 file2 ...
(exact text substitution)

# doconce replace using from and to phrases from file
doconce replace_from_file file-with-from-to-replacements file1 file2 ...

# search for a (regular) expression in all .do.txt files in
# the current directory tree (useful when removing compilation errors)
doconce find expression

# print an overview of how various files are included in the root doc
doconce include_map mydoc.do.txt
```

```

# replace all mako function calls by the results of the calls
doconce expand_mako mako_code_file funcname file1 file2 ...

# remove all inline comments in a doconce file
doconce remove_inline_comments dofile

# apply all edits specified through inline comments
apply_inline_edits

# create a directory for the sphinx format
doconce sphinx_dir copyright='John Doe' title='Long title' \
    short_title="Short title" version=0.1 intersphinx \
    dirname=sphinx-rootdir theme=default logo=/path/to/mylogo.png \
    dofile
(require sphinx version >= 1.1)

# walk through a directory tree and insert doconce files as
# docstrings in *.p.py files
doconce insertdocstr rootdir

# remove all redundant files (keep source .do.txt and results:
# .pdf, .html, sphinx- dirs, .mwiki, .ipynb, etc.)
doconce lightclean

# remove all files that the doconce can regenerate
doconce clean

# change encoding
doconce change_encoding utf-8 latin1 dofile

# guess the encoding in a text
doconce guess_encoding filename

# find non-ascii characters in a file
doconce find_nonascii_chars file1 file2 ...

# split a sphinx/rst file into parts
doconce format sphinx complete_file
doconce split_rst complete_file # !split specifies the splitting points
doconce sphinx_dir complete_file
python automake_sphinx.py

# split an html file into parts according to !split commands
doconce split_html complete_file.html

# create HTML slides from a (doconce) html file
doconce slides_html slide_type complete_file.html

# create LaTeX Beamer slides from a (doconce) latex/pdflatex file
doconce slides_beamer complete_file.tex

# create Remark slides from Markdown
doconce slides_markdown complete_file.md remark --slide_style=light

# replace bullets in lists by colored bullets
doconce html_colorbullets file1.html file2.html ...

# extract all exercises (projects and problems too)
doconce extract_exercises tmp_mako__mydoc

# grab selected text from a file
doconce grab --from[-] from-text [--to[-] to-text] somefile > result

```

```

# remove selected text from a file
doconce remove --from[-] from-text [--to[-] to-text] somefile > result

# list all figure, movie or included code files
doconce grep FIGURE|MOVIE|CODE dofile

# run spellcheck on a set of files
doconce spellcheck [-d .mydict.txt] *.do.txt

# transform ptex2tex files (.p.tex) to ordinary latex file
# and manage the code environments
doconce ptex2tex mydoc -DMINTED pycod=minted sys=Verbatim \
    dat=\begin{quote}\begin{verbatim};\end{verbatim}\end{quote}

# make HTML file via pandoc from Markdown (.md) file
doconce md2html file.md

# make LaTeX file via pandoc from Markdown (.md) file
doconce md2latex file.md

# combine several images into one
doconce combine_images image1 image2 ... output_file

# report problems from a LaTeX .log file
doconce latex_problems mydoc.log [overfull-hbox-limit]

# list all figure files, movie files, and source code files needed
doconce list_fig_src_files *.do.txt

# list all labels in a document (for purposes of cleaning them up)
doconce list_labels myfile

# generate script for substituting generalized references
doconce ref_external mydoc [pubfile]

# check all links in HTML files
doconce linkchecker *.html

# change headings from "This is a Heading" to "This is a heading"
doconce capitalize [-d .mydict.txt] *.do.txt

# translate a latex document to doconce (requires usually manual fixing)
doconce latex2doconce latexfile

# check if there are problems with translating latex to doconce
doconce latex_dislikes latexfile

# translate an IPython/Jupyter notebook to doconce
doconce ipynb2doconce notebookfile

# typeset a doconce document with pygments (for pretty print of doconce itself)
doconce pygmentize myfile [pygments-style]

# generate a make.py script for translating a doconce file to various formats
doconce makefile docname doconcefile [html sphinx pdflatex ...]

# find differences between two files
doconce diff file1.do.txt file2.do.txt [diffprog]
(diffprog can be diff, pdiff, latexdiff, kdiff3, diff, ...)

# find differences between the last two Git versions of several files
doconce gitdiff file1 file2 file3 ...

# convert csv file to doconce table format

```

```
doconce csv2table somefile.csv

# edit URLs to local files and place them in _static
doconce sphinxfix_local_URLs file.rst

# replace latex-1 (non-ascii) characters by html codes
doconce latin2html file.html

# fix common problems in bibtex files for publish import
doconce fix_bibtex4publish file1.bib file2.bib ...

# print the header (preamble) for latex file
doconce latex_header

# print the footer for latex files
doconce latex_footer

# expand short cut commands to full form in files
doconce expand_commands file1 file2 ...

# insert a table of exercises in a latex file myfile.p.tex
doconce latex_exercise_toc myfile
```

## 0.21 Exercises

DocOnce supports *Exercise*, *Problem*, *Project*, and *Example*. These are typeset as ordinary sections and referred to by their section labels. Exercise, problem, project, or example sections contains certain *elements*:

- a headline at the level of a subsection containing one of the words "Exercise:", "Problem:", "Project:", or "Example:", followed by a title (required)
- a label (optional)
- a solution file (optional)
- name of file with a student solution (optional)
- main exercise text (required)
- a short answer (optional)
- a full solution (optional)
- one or more hints (optional)
- one or more subexercises (subproblems, subprojects), which can also contain a text, a short answer, a full solution, name student file to be handed in, and one or more hints (optional)

A typical sketch of a a problem without subexercises goes as follows:

```
===== Problem: Derive the Formula for the Area of an Ellipse =====
label{problem:ellipsearea1}
file=ellipse_area.pdf
solution=ellipse_area1_sol.pdf
```

Derive an expression for the area of an ellipse by integrating the area under a curve that defines half of the ellipse. Show each step in the mathematical derivation.

!bhint  
Wikipedia has the formula for the curve.  
!ehint

!bhint  
"Wolframalpha": "http://wolframalpha.com" can perhaps compute the integral.  
!ehint

If the exercise type (Exercise, Problem, Project, or Example) is enclosed in braces, the type is left out of the title in the output. For example, the if the title line above reads

==== {Problem}: Derive the Formula for the Area of an Ellipse =====

the title becomes just "Derive the ...".

An exercise with subproblems, answers and full solutions has this setup-up:

==== Exercise: Determine the Distance to the Moon =====  
label{exer:moondist}

Intro to this exercise. Questions are in subexercises below.

!bsubex  
Subexercises are numbered a), b), etc.

file=subexer\_a.pdf

!bans  
Short answer to subexercise a).  
!eans

!bhint  
First hint to subexercise a).  
!ehint

!bhint  
Second hint to subexercise a).  
!ehint  
!esubex

!bsubex  
Here goes the text for subexercise b).

file=subexer\_b.pdf

!bhint  
A hint for this subexercise.  
!ehint

!bsol  
Here goes the solution of this subexercise.  
!esol  
!esubex

!bremarks  
At the very end of the exercise it may be appropriate to summarize and give some perspectives. The text inside the '!bremarks' and '!eremarks'

```

directives is always typeset at the end of the exercise.
!eremarks

!bsol
Here goes a full solution of the whole exercise.
!esol

```

By default, answers, solutions, and hints are typeset as paragraphs. The command-line arguments `--without_answers` and `--without_solutions` turn off output of answers and solutions, respectively, except for examples.

## 0.22 Environments

DocOnce environments start with `!benvironmentname` and end with `!eenvironmentname`, where `environmentname` is the name of the environment. Here is a listing of the environments:

- `c`: computer code (or verbatim text)
- `t`: math blocks with  $\text{\LaTeX}$  syntax
- `subex`: sub-exercise
- `ans`: short answer to exercise or sub-exercise
- `sol`: full solution to exercise or sub-exercise
- `hint`: multiple help items in an exercise or sub-exercise
- `quote`: indented text
- `notice`, `summary`, `warning`, `question`: admonition boxes with custom title, special icon, and (sometimes) background color
- `block`, `box`: simpler boxes (`block` may have title but never any icon)
- `pop`: text to gradually pop up in slide presentations
- `slidecell`: indication of cells in a grid layout for elements on a slide

In addition, the user can define new environments `!bc-name` as explained in the [manual](#).

## 0.23 Preprocessing

DocOnce documents may utilize a preprocessor, either `preprocess` and/or `mako`. The former is a C-style preprocessor that allows if-tests and including other files (but not macros with arguments). The `mako` preprocessor is much more advanced - it is actually a full programming language, very similar to Python.



The command `doconce format` first runs `preprocess` and then `mako`. Here is a typical example on utilizing `preprocess` to include another document, “comment out” a large portion of text, and to write format-specific constructions:

```
# #include "myotherdoc.do.txt"

# #if FORMAT in ("latex", "pdflatex")
\begin{table}
\caption{Some words... label{mytab}}
\begin{tabular}{lrr}
\hline\noalign{\smallskip}
\multicolumn{1}{c}{time} & \multicolumn{1}{c}{velocity} & \multicolumn{1}{c}{acceleration} \\
\hline
0.0          & 1.4186      & -5.01      \\
2.0          & 1.376512    & 11.919     \\
4.0          & 1.1E+1      & 14.717624  \\
\hline
\end{tabular}
\end{table}
# #else
|-----|
| time | velocity | acceleration |
|-----|
| 0.0  | 1.4186   | -5.01        |
| 2.0  | 1.376512 | 11.919       |
| 4.0  | 1.1E+1   | 14.717624    |
|-----|
# #endif

# #ifdef EXTRA_MATERIAL
....large portions of text...
# #endif
```

With the `mako` preprocessor the if-else tests have slightly different syntax. An [example document](#) contains some illustrations on how to utilize `mako` (clone the GitHub project and examine the DocOnce source and the `doc/src/make.sh` script).

## 0.24 Resources

- Excellent "Sphinx Tutorial" by C. Reller: "<http://people.ee.ethz.ch/~creller/web/tricks/reST.html>"