



SKILLPILLS

Skill Pill: \LaTeX Course

Lecture 2: Further Typesetting

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- 2 Counters and Lengths
- 3 Header and Footer
- 4 Title Page
- 5 Bibliography
- 6 Biblatex
- 7 New Commands
- 8 Multiple \LaTeX Files
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- 11 Further Packages

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Absolute Units:

cm

mm

pt 1 pt = 0,351459804 mm

in 1 inch = 2,54 cm

Relative Units:

em width of the capital 'M' in the font in use

ex heights of the lowercase 'x' in the font in use

Horizontal spacing:

`\hspace{length}` creates a horizontal space of the defined length except at the beginning or end of a line

`\hspace*{length}` similar to `\hspace{length}`, but it also works at the beginning or end of a line

`\hfill` creates a 'rubber length', which means that it will expand as much as needed to fill the line maximally.

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`\hfill` creates a 'rubber length', which means that it will expand as much as needed to fill the line maximally.

`\dotfill` similar to `\hfill`, but with dots

`\hrulefill` similar to `\hfill`, but with a line

Vertical spacing:

`\vspace{length}` creates a vertical space of the defined length in between two paragraphs except at the beginning or end of a page

`\vspace*{length}` similar to `\vspace{length}`, but it also works at the beginning or end of a page

`\vfill` creates a 'rubber length', which means that it will expand as much as needed to fill the page maximally.

Vertical spacing:

`\vspace{length}` creates a vertical space of the defined length in between two paragraphs except at the beginning or end of a page

`\vspace*{length}` similar to `\vspace{length}`, but it also works at the beginning or end of a page

`\vfill` creates a 'rubber length', which means that it will expand as much as needed to fill the page maximally.

`\\[length]` creates a vertical space of the defined length after the line break

Predefined horizontal spacing:

`\quad` creates a horizontal space of 1em

`\qquad` creates a horizontal space of 2em

Predefined horizontal spacing:

`\quad` creates a horizontal space of 1em

`\qquad` creates a horizontal space of 2em

Predefined vertical spacing:

`\smallskip` creates a small vertical space

`\medskip` creates a medium vertical space

`\bigskip` creates a big vertical space

The exact size of the commands depends on the document class.

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Counters are integers which are used for numbering various objects.

Important counters are:

`page` counts the pages

`section` counts the sections (c. f. subsection, subsubsection)

`equation` counts the numbered equations

`enumi` counts the numbered items of the `enumerate` environment
(first layer, `enumii`, `enumiii`, `enumiv`, ... for the deeper layers)

\LaTeX is organizing those counters automatically.

Counters can be manipulated using the following commands:

`\setcounter{counter}{value}` changes counter to value.

`\addtocounter{counter}{value}` adds value to counter.

`\stepcounter{counter}` increases the value of counter by 1 and resets all dependent counters to zero.

`\refstepcounter{counter}` similar to `\stepcounter{counter}`, but also adds a label for referencing.

You can define your own counters using:

`\newcounter{myCounter}[higherrankcounter]` creates a new counter, with the name `myCounter` having the value 0. You can add an existing counter as optional argument (`higherrankcounter`) so that every time this counter is increased using `\stepcounter{higherrankcounter}` the new counter `myCounter` is set back to 0.

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With `\value{counter}` you can use the value of the counter in the source code. This command is not for printing the value in the document, but rather for handling.

Example:

```
\setcounter{Counter2}{\value{Counter1}}
```

Counter2 is set to the value of Counter1

If you want to start the document from page 5, you can use

```
\setcounter{page}{5}
```

at the beginning of the document.

Beginning of my enumeration.

1. this
2. and
3. that

At this point I want to continue my enumeration.

4. he
5. she
6. it

In order to print the counters you can use different commands:

`\arabic{counter}` prints the value of counter as an arabic number (4).

`\roman{counter}` prints the value of counter as an lower case roman number (iv).

`\Roman{counter}` prints the value of counter as an upper case roman number (IV).

`\alph{counter}` prints the value of counter as an lower case letter (d).

`\Alph{counter}` prints the value of counter as an upper case letter (D).

Similar to counters you can also create and manipulate lengths:

`\newlength{\name}` creates the length `\name` and sets it to 0pt.

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`\setlength{\name}{value}` sets the length of `\name` to `value`.

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`\addtolength{\name}{value}` adds `value` to `\name`.

`\settowidth{\name}{text}` sets the value of `\name` to the width of `text` in the current font.

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`\newlength{\name}` creates the length `\name` and sets it to 0pt.

`\setlength{\name}{value}` sets the length of `\name` to `value`.

`\addtolength{\name}{value}` adds `value` to `\name`.

`\settowidth{\name}{text}` sets the value of `\name` to the width of `text` in the current font.

`\settoheight{\name}{text}` sets the value of `\name` to the heights of `text` above the baseline.

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`\newlength{\name}` creates the length `\name` and sets it to 0pt.

`\setlength{\name}{value}` sets the length of `\name` to `value`.

`\addtolength{\name}{value}` adds `value` to `\name`.

`\settowidth{\name}{text}` sets the value of `\name` to the width of `text` in the current font.

`\settoheight{\name}{text}` sets the value of `\name` to the heights of `text` above the baseline.

`\settodepth{\name}{text}` sets the value of `\name` to the heights of `text` below the baseline.

Lengths can for example be used as arguments for `\hspace{}`:

```
\newlength{\length}  
\settowidth{\length}{A few words}  
  
:  
  
\hspace{\length}
```

Lengths can be modified by multiplication:

```
\includegraphics[width=0.5\textwidth]{figure.jpg}
```

Helpful lengths are e. g.

`\textwidth` width of the text

`\textheight` heights of the text

`\baselineskip` line spacing

`\parindent` indent at the beginning of a paragraph

`\parskip` vertical distance between two paragraphs

Helpful lengths are e. g.

`\textwidth` width of the text

`\textheight` heights of the text

`\baselineskip` line spacing

`\parindent` indent at the beginning of a paragraph

`\parskip` vertical distance between two paragraphs

With `\parindent` and `\parskip` you can for example customize the layout of your paragraphs.

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The `\pagestyle{style}` command can be used to layout the content of the header and footer. `style` can be chosen from the following:

`empty` empty header and footer

`plain` page number in the footer (standard)

`headings` chapter or section titles in the header (formatting depends on the document class)

`myheadings` content of header and footer can be defined manually (the `scrlayer-scrpage` package offers an even greater variety)

If the `\pagestyle{style}` is placed within the preamble it affects the whole document, however if placed within the document it only has effect starting from the placement of the command. If you want to change the layout of a single page you can use `\thispagestyle{style}`.

4. Streuung eines Bessel-Strahls an einer ebenen Elektronenwelle

Aufgrund der Relation

$$\dot{z}_{\sigma_1}(\theta, \varphi) \cdot \dot{z}_{\Delta}(\theta_k, \varphi_k) = \dot{z}_{\sigma_1}(\theta, 0) \cdot \dot{z}_{\Delta}(\theta_k, \varphi_k - \varphi), \quad (4.12)$$

die sich leicht überprüfen lässt, und der Integration über φ , hängt der differentielle Wirkungsquerschnitt nicht vom Azimutwinkel φ des gestreuten Photons ab. Daher kann der Einfachheit halber $\varphi = 0$ für die Berechnung angenommen werden. Dies ist zu erwarten, da auch bei der Streuung eines Bessel-Strahls zirkulärer Polarisation keine Richtung ausgezeichnet ist. (Zur Lösung des Integrals und Summation über die orthogonale Polarisationszustände σ_j erhält man für den differentiellen Wirkungsquerschnitt für die Thomson-Streuung eines Bessel-Strahls schließlich einen kompakten analytischen Ausdruck:

$$\frac{d\sigma_{tw}}{d\Omega} = \frac{r_e^2}{4} [(1 + \cos^2 \theta_k)(1 + \cos^2 \theta) + 2 \sin^2 \theta_k \sin^2 \theta] . \quad (4.13)$$

Wie man leicht nachrechnet, erhält man im Fall $\theta_k = 0$ das Ergebnis für ebene Wellen, siehe Gl. (3.16). Man erkennt ebenfalls, dass die topologische Ladung m in dem Ausdruck nicht vorkommt, sie hat also keinen Einfluss auf die Winkelverteilung.

4.3 Berechnung der Stokes-Parameter

Die Untersuchung der Polarisierung der gestreuten Strahlung geschieht mittels der Stokes-Parameter, die man gemäß Unterabschnitt 2.3.3 aus der Dichtematrix erhält. Die Elemente der Dichtematrix sind

$$\rho_{\mathcal{E}\mathcal{E}'} = \int \frac{d\varphi_k}{2\pi} \frac{(\hat{\mathbf{z}}_g^*(\theta, 0) \cdot \hat{\mathbf{z}}_\Lambda(\theta_k, \varphi_k)) (\hat{\mathbf{z}}_{g'}^*(\theta, 0) \cdot \hat{\mathbf{z}}_\Lambda(\theta_k, \varphi_k))^*}{\frac{1}{2} [(1 + \cos^2 \theta_k)(1 + \cos^2 \theta) + 2 \sin^2 \theta_k \sin^2 \theta]}. \quad (4.14)$$

Die Integration ergibt

$$\rho = \frac{1}{(1 + \cos^2 \theta_k)(1 + \cos^2 \theta) + 2 \sin^2 \theta_k \sin^2 \theta} \times \begin{pmatrix} (1 + \cos^2 \theta_k) \cos^2 \theta + 2 \sin^2 \theta_k \sin^2 \theta & -2iA \cos \theta_k \cos \theta \\ 2iA \cos \theta_k \cos \theta & 1 + \cos^2 \theta_k \end{pmatrix} \quad (4.15)$$

und daraus erhält man die Stokes-Parameter als kompakte analytische Ausdrücke

$$\tilde{P}_1 = \frac{(1 - 3 \cos^2 \theta_k) \sin^2 \theta}{(1 + \cos^2 \theta_k)(1 + \cos^2 \theta) + 2 \sin^2 \theta \cdot \sin^2 \theta}, \quad (4.16)$$

$$\tilde{P}_2 = 0, \quad (4.17)$$

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4.4 Einfluss der Parameter des Bessel-Strahls auf Winkelverteilung und Polarisation

$$\tilde{P}_3 = \frac{4\Lambda \cos \theta_k \cos \theta}{(1 + \cos^2 \theta_k)(1 + \cos^2 \theta) + 2 \sin^2 \theta_k \sin^2 \theta} \quad (4.18)$$

Im Gegensatz zum differentiellen Wirkungsquerschnitt sind die Stokes-Parameter von der Helizität des Bessel-Strahls abhängig, diese bestimmt das Vorzeichen von \tilde{P}_y . Aus den Stokes-Parametern ergibt sich der Polarisationsgrad zu

$$\Pi = \frac{\sqrt{(1 - 3 \cos^2 \theta_k)^2 \sin^4 \theta + 16 \cos^2 \theta_k \cos^2 \theta}}{(1 + \cos^2 \theta_k)(1 + \cos^2 \theta) + 2 \sin^2 \theta_k \sin^2 \theta}. \quad (4-19)$$

Auch hier erkennt man, dass sich im Fall $\theta_k = 0$ die Stokes-Parameter und der Polarisationsgrad für ebene Wellen (siehe Gln. (3.19) und (3.20)) ergeben.

4.4 Einfluss der Parameter des Bessel-Strahls auf Winkelverteilung und Polarisation

Die topologische Ladung m hat keinen Einfluss auf Winkelverteilung und Polarisation der gestreuten Strahlung, da sie in der Entwicklung (2.49) lediglich in Form eines Phasenterms innerhalb der Amplituden a_{nm} in die Berechnung eingeht, der durch die Bildung des Betragsquadrates verschwindet.

4.4.1 Einfluss der Helizität Λ

Die Helizität A des Bessel-Strahls bestimmt lediglich das Vorzeichen von \tilde{P}_3 , die Winkelverteilung und die restlichen Stokes-Parameter hängen nicht von ihr ab. Dies ist zu erwarten, da \tilde{P}_3 den Anteil der zirkularen Polarisierung angibt und das Vorzeichen die entsprechende Helizität beschreibt. In dieser Hinsicht verhalten sich Bessel-Strahlen und ebene Photonenwellen gleich.

4.4.2 Einfluss des Öffnungswinkels θ .

In Abbildung 4.1 ist die Winkelverteilung der gestreuten Photonen für verschiedene Öffnungswinkel θ_k zwischen 0 und 90° dargestellt. Der Fall $\theta_k = 90^\circ$ ist dabei ein rein theoretischer Grenzfall: In diesem Fall ist $k_z = 0$, die Welle propagiert also nicht mehr entlang der z -Achse, sondern nur noch in radialer Richtung. Er wird hier dennoch angeführt, um die theoretischen Grenzen aufzuzeigen.

Für $\theta_k = 0$ entsprechen der differentiellen Wirkungsquerschnitt und die Stokes-Parameter exakten für den Streuung einer ebenen Welle. Je größer der Öffnungswinkel ist, desto deutlicher werden die Unterschiede.

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With the scrlayer-scrpage package you can customize the header and the footer of the document. For further information visit:

<http://sunsite.informatik.rwth-aachen.de/ftp/pub/mirror/ctan/macros/latex/contrib/koma-script/doc/scrguien.pdf>

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If `titlepage` is set as an optional argument for the document class, a separated title page will be created. This is standard for some document classes.

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Example:

```
\documentclass[titlepage]{scrartcl}
```

In order to customize your title page you can use the titlepage environment.

The title page is defined within `\begin{titlepage}...\end{titlepage}`.

Many examples may be found in the linked document.

<http://ftp.jaist.ac.jp/pub/CTAN/info/latex-samples/TitlePages/titlepages.pdf>

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In order to create a bibliography you can use the thebibliography environment.

Example:

```
\begin{thebibliography}{2}  
\bibitem{jackson} J.D. Jackson:  
\emph{Classical Electrodynamics.}  
$3^{\mathrm{rd}}$ Ed., New York: Wiley, 1999.  
\bibitem{sakurai} J.J. Sakurai:  
\emph{Advanced Quantum Mechanics.}  
Reading, Mass.: Addison-Wesley, 1967.  
\end{thebibliography}
```

The second argument {2} denotes the longest label in the bibliography.

References

- [1] J.D. Jackson: *Classical Electrodynamics*. 3rd Ed., New York: Wiley, 1999.
- [2] J.J. Sakurai: *Advanced Quantum Mechanics*. Reading, Mass.: Addison-Wesley, 1967.

The bibliography items can be referenced in the text using `\cite{key}`, which creates a label based in the definition in the bibliography.

Example:

```
Further calculations may be found in the textbook  
of J.D. Jackson \cite{jackson}.
```

creates

Further calculations may be found in the textbook of J.D. Jackson [1].

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The Bibl_{at}ex packages offers the possibility to create a bibliography based on a `.bib` file.

The Biblatex packages offers the possibility to create a bibliography based on a .bib file.

The entries of a .bib file look for example like this:

```
@article{rechtsman2013PhoFlotopins,  
  author = {Rechtsman, Mikael C and Zeuner, Julia M and  
            Plotnik, Yonatan and Lumer, Yaakov and Podolsky, Daniel  
            and Dreisow, Felix and Nolte, Stefan and Segev,  
            Mordechai and Szameit, Alexander},  
  journal = {Nature},  
  number = {7444},  
  pages = {196--200},  
  publisher = {Nature Publishing Group},  
  title = {{Photonic Floquet topological insulators}},  
  url = {http://www.nature.com/nature/journal/v496/n7444/  
        abs/nature12066.html},  
  volume = {496},  
  year = {2013}  
}
```

```
\usepackage{hyperref}

\usepackage[sorting=none, hyperref, maxbibnames=6]{biblatex}

\addbibresource{literature.bib}

\begin{document}

As it was shown by Rechtsman et al.
    \cite{rechtsman2013PhoFlotopins} \dots

\printbibliography

\end{document}
```

As it was shown by Rechtsman et al. [1] ...

References

- [1] Mikael C Rechtsman et al. “Photonic Floquet topological insulators”. In: *Nature* 496.7444 (2013), pp. 196–200. URL: <http://www.nature.com/nature/journal/v496/n7444/abs/nature12066.html>.

As it was shown by Rechtsman et al. [1] ...

References

- [1] Mikael C Rechtsman et al. “Photonic Floquet topological insulators”. In: *Nature* 496.7444 (2013), pp. 196–200. URL: <http://www.nature.com/nature/journal/v496/n7444/abs/nature12066.html>.

One of the advantages of the biblatex package are the numerous options.

As it was shown by Rechtsman et al. [1] ...

References

- [1] Mikael C Rechtsman et al. “Photonic Floquet topological insulators”. In: *Nature* 496.7444 (2013), pp. 196–200. URL: <http://www.nature.com/nature/journal/v496/n7444/abs/nature12066.html>.

One of the advantages of the biblatex package are the numerous options.

Documentation: <http://ftp.jaist.ac.jp/pub/CTAN/macros/latex/contrib/biblatex/doc/biblatex.pdf>

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To define a new command you can use

```
\newcommand{\commandname}{definition of command}
```


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```
\newcommand{\commandname}{definition of command}
```

Example:

```
\newcommand{\degcelsius}{\,\text{\textcircled{\scriptsize C}}}
```

To define a new command you can use

```
\newcommand{\commandname}{definition of command}
```

Example:

```
\newcommand{\degcelsius}{\text{\textasciicircum\circ\mathrm{C}}}
```

From now on you can use `\degcelsius` throughout your whole document:

`$T=23\degcelsius$` creates $T = 23^{\circ}\text{C}$.

You can also define commands with arguments:

```
\newcommand{\commandname}[number of arguments]{definition  
  of command}
```

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```
\newcommand{\commandname}[number of arguments]{definition  
  of command}
```

Example:

```
\newcommand{\degcelsius}[1]{#1\,^{\circ}\mathrm{C}}
```

You can also define commands with arguments:

```
\newcommand{\commandname}[number of arguments]{definition  
  of command}
```

Example:

```
\newcommand{\degcelsius}[1]{#1\,^{\circ}\mathrm{C}}
```

Now `\degcelsius{}` can be used as command: `$T=\degcelsius{23}$`
creates $T = 23^{\circ}\text{C}$.

In order to redefine an existing command you have to use `\renewcommand{} [] {}` instead of `\newcommand{} [] {}` with the same syntax.

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In order to structure the document you can use different files (e. g. for different chapters). You include those files into your main document using

```
\include{file/path}
```

or

```
\input{file/path}
```

The command `\input` includes the content without any page breaks, whereas `\include` causes a page break before and after the content of the loaded file. Furthermore one can not nest `\include`.

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With the definition of `DIV=x` as an optional argument of the document class one can change the size of the type area. (`x` refers to the number of stripes into which the page is divided horizontally and vertically during the page layout construction) In general one can say that a bigger number `x` results in more text per page.

For further information please read:

<http://sunsite.informatik.rwth-aachen.de/ftp/pub/mirror/ctan/macros/latex/contrib/koma-script/doc/scrguien.pdf>

Manual Modification of the Type Area with the geometry Package

In order to modify the type area in one can use the geometry package. It offers numerous options to change margins, paper formats etc.

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Example for margins:

```
\usepackage[left=3cm, right=3cm, top=3cm,  
  bottom=4cm]{geometry}
```

Manual Modification of the Type Area with the geometry Package

In order to modify the type area in one can use the geometry package. It offers numerous options to change margins, paper formats etc.

Example for margins:

```
\usepackage[left=3cm, right=3cm, top=3cm,  
bottom=4cm]{geometry}
```

For further reading visit: <http://ftp.jaist.ac.jp/pub/CTAN/macros/latex/contrib/geometry/geometry.pdf>

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In order to change the line spacing one can use the setspace package.

Example:

```
\usepackage[onehalfspacing]{setspace}
```

creates a document with 1.5 line spacing.

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Example:

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\usepackage[onehalfspacing]{setspace}
```

creates a document with 1.5 line spacing.

Possible options:

`singlespacing` (standard)

`onehalfspacing`

`doublespacing`

In order to change the line spacing one can use the setspace package.

Example:

```
\usepackage[onehalfspacing]{setspace}
```

creates a document with 1.5 line spacing.

Possible options:

`singlespacing` (standard)

`onehalfspacing`

`doublespacing`

Those options may be used as a declaration (switch), e. g.

`\doublespacing` changes the format to double spacing. (from that point on).

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In order to write physical quantities one may use the `siunitx` package:

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```
\SI[per-mode=fraction]{1,345e-5}{\coulomb\per\mole}
```

creates $1.345 \times 10^{-5} \frac{\text{C}}{\text{mol}}$.

In order to write physical quantities one may use the siunitx package:

```
\SI[per-mode=fraction]{1,345e-5}{\coulomb\per\mole}
```

creates $1.345 \times 10^{-5} \frac{\text{C}}{\text{mol}}$.

Documentation: <http://ftp.rrzn.uni-hannover.de/pub/mirror/tex-archive/macros/latex/contrib/siunitx/siunitx.pdf>

If one wants to change the thickness of *all* lines in a table one can redefine `\arrayrulewidth`:

```
\setlength{\arrayrulewidth}{1.0pt}
```

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```
\setlength{\arrayrulewidth}{1.0pt}
```

In order to use lines of different thickness (or to make nicer tables in general) one can use the `booktabs` package. It defines `\toprule`, `\midrule`, `\bottomrule`, and `\cmidrule` instead of `\hline`, and `\cline{}`.

If one wants to change the thickness of *all* lines in a table one can redefine `\arrayrulewidth`:

```
\setlength{\arrayrulewidth}{1.0pt}
```

In order to use lines of different thickness (or to make nicer tables in general) one can use the `booktabs` package. It defines `\toprule`, `\midrule`, `\bottomrule`, and `\cmidrule` instead of `\hline`, and `\cline{}`.

Documentation: [http:](http://cs.brown.edu/about/system/managed/latex/doc/booktabs.pdf)

[//cs.brown.edu/about/system/managed/latex/doc/booktabs.pdf](http://cs.brown.edu/about/system/managed/latex/doc/booktabs.pdf)

If you want the text to be wrapped around the figure you can use the wrapfig package.

Example:

```
\begin{wrapfigure}{r}{0.5\textwidth}  
  \includegraphics[width=0.45\textwidth]{figure.jpg}  
\end{wrapfigure}
```

Documentation: <http://ftp.jaist.ac.jp/pub/CTAN/macros/latex/contrib/wrapfig/wrapfig-doc.pdf>

The `cleveref` package is designed to simplify referencing by e. g. taking care of the formatting and sorting.

Example:

```
\crefrange{eq1}{eq5}
```

is used instead of

```
eqs.~(1) to~(5)
```

Documentation: <http://ftp.jaist.ac.jp/pub/CTAN/macros/latex/contrib/cleveref/cleveref.pdf>