
SYMBOLIC SOFTWARE LAB: LATEX 2

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110111 Symbolic Software Lab, Module III

Goal of Today's Lecture

- non-text components of scientific texts
- what they should look like
- how to achieve this using \LaTeX

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- non-text components of scientific texts
- what they should look like
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- Please do course evaluation.

Outline

1. Figures and Page Layout

- Graphics
- Tables
- Table-Like Mathematics

2. Bibliographies

3. Programming in \LaTeX

4. Useful Packages and Outlook

1. Figures and Page Layout

Contents

1. Figures and Page Layout

- Graphics
- Tables
- Table-Like Mathematics

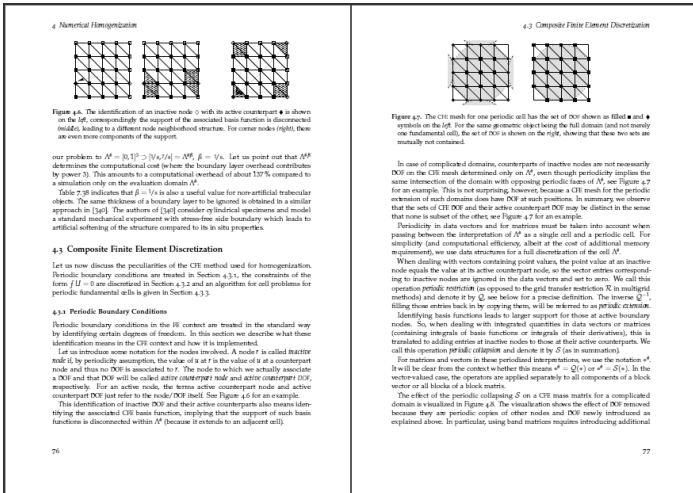
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1. Figures and Page Layout

Figure Examples



1. Figures and Page Layout

Figure Examples

7 Numerical Results and Applications

Table 7.4. Sample geometries ($3 \times 3 \times 3$ trabeculae) with the same diameter-to-length ratios δ/l in all space directions and with thinner transverse trabeculae were resolved at different resolutions. Results obtained on 9^3 to 25^3 grids were compared to the results for a 51^3 grid, considering the fraction of volume segmented, and a relative L^2 error of the displacement for compression and shear simulations, and the imposed displacement.

grid	$\delta/l = (0.2, 0.2, 0.4)$			$\delta/l = (0.4, 0.4, 0.4)$		
	volume fraction	rel. error (comp)	rel. error (shear)	volume fraction	rel. error (comp)	rel. error (shear)
9^3	0.841416	0.040775	0.020782	0.803484	0.050966	0.027218
12^3	0.979785	0.073752	0.044527	0.976767	0.055301	0.046402
15^3	0.992192	0.086604	0.050219	0.992375	0.057203	0.051090
60^3	0.997183	0.024943	0.044567	0.997332	0.003150	0.004636
120^3	0.999167	0.014846	0.031654	0.999344	0.001287	0.001677
25^3	0.999423	0.000456	0.000530	0.999668	0.000443	0.000561

Table 7.5. For numerical consistency tests we considered the domain on the left. Results obtained at different resolutions were compared to reference solutions computed on 51^3 and 25^3 grids, respectively, using pointwise l^2 and Frobenius norms for the vector-valued displacement and its derivative.

grid	scalar problem		elasticity problem	
	L^2 error	L^2 error	L^2 error	H^1 error
12^3	0.055279	0.009245	0.399335	0.266084
15^3	0.023502	0.003360	0.194077	0.108070
60^3	0.009312	0.001092	0.007312	0.051376
120^3	0.004490	0.000388	0.004578	0.049309
25^3	0.002319	0.000090	0.023263	0.000230




Table 7.6. The numbers of degrees of freedom and the total memory requirement (in MB) are listed for the complicated domain elasticity simulations for $\delta/l = (0.2, 0.2, 0.4)$ (left) in Table 7.4, as well as for the scalar and elasticity problem with discontinuous coefficients in Table 7.5 (middle and right).

grid	Tab 7.4, $\delta/l = (0.2, 0.2, 0.4)$		Tab 7.5, scalar		Tab 7.5, elasticity	
	# DOF	memory	# DOF	memory	# DOF	memory
9^3	1395	4	4913	102	14739	137
12^3	8163	14	274625	262	823975	822
15^3	39789	67	353037	132	1074111	263
60^3	213309	327	274625	262	823975	822
120^3	1388175	1857	2146489	874	6440107	3315
25^3	4962185	16494	16494361	3414	50923779	16307
51^3	71219481	73163	138100567	19456		

7.1 Numerical Tests

Heat Diffusion and Linear Elasticity with Discontinuous Coefficients. Furthermore, we considered the 3^d rod interface shown in Table 7.5. For this configuration we computed the solutions of a scalar boundary value problem (isotropic coefficient with link ratio $\kappa = 42$, boundary values 0 and 1 on two opposite faces of the cube) and an elasticity problem (compression by 1 in 2 directions, which clearly lies far outside the physical range of (even non-)linear elasticity, and material parameters $E = 5$, $\nu = 0.2$ in the rods and $E = 1$, $\nu = 0.2$ in the embedding) [28]. The solutions were computed at different resolution and compared to a reference solution obtained on a 51^3 grid (scalar problem) and a 25^3 grid (elasticity problem). We evaluated the L^2 , H^1 , and H^2 norms of the difference by midpoint quadrature now on the finest 9^3 . In the elasticity case, pointwise l^2 and Frobenius norms were used for differences of the vector-valued quantity and its derivatives, respectively.

We observe in both problems that convergence in L^2 is far from second order (which is due to outliers at individual quadrature points) whereas convergence in H^1 is closer to order 2 and in H^2 we have almost perfect first order convergence.

Memory Requirements. As in [29] we also list the number of degrees of freedom and the memory requirements for some simulations in this section.

Table 7.6 shows that, unlike in the discontinuous coefficient case, not every node of $\mathcal{A}_h^{2,2}$ was assigned degrees of freedom for a complicated domain. Moreover, the elasticity problems clearly need 3 DOF per grid node. Even though the interfaces are different in the two cases, one can see that higher density of matrix entries caused by larger parent sets $\mathcal{P}(2)$ of virtual nodes 2 and the vector-valued CH construction weights in the discontinuous coefficient case lead to larger memory requirement compared to the complicated domain case.

7.1.4 Condition Numbers of CFE Matrices

Let us now extend the investigation of condition numbers for CFE matrices in [28]. For this purpose and to pronounce the influence of intersected grid cells, we considered an interface perpendicular to the z_3 axis located in $(0.5, 0.75)$ where the computational resolution is 9^3 and with higher sample density near the interfacial boundaries. A 2D projection of this division of the unit cube in two bricks is shown in Figure 7.7, the extension in the third space direction is constant.

We considered the matrix $M = \mathbf{v} \cdot \mathbf{v}$ for $\mathbf{v} := \mathbf{h}$ arising in an implicit Lufe scheme for a time-dependent heat diffusion problem and the matrix for an elasticity problem with Dirichlet boundary conditions at the top and bottom. For the complicated domain case, the diffusivity was assumed to be 1 and the material properties for linear elasticity were set to $E = 1$ Pa, $\nu = 0.33$. For the discontinuous coefficient cases, the scalar link ratio was $\kappa = 42$. In the vector-valued case we used $(E^-, \nu^-) = (70, 0.35)$ and $(E^+, \nu^+) = (3, 0.35)$. With E as GPa, these are realistic values for aluminum and PMMA. Furthermore for the discontinuous coefficient cases, we varied the scalar link ratio and the stiffness E^- for $(E^-, \nu^-) = (1.0, 0.3)$ for fluid geometrical location of the interface.

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115

1. Figures and Page Layout

Introduction to Figures I

Figures are non-text material (but of course may contain text)

- tables
- sketches
- plots
- images

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Properties

- not placed inside text
- number that can (should) be referenced in the main text
- caption (should be self-contained)
- many readers just browse through figures and captions

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Properties

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LaTeX has two main environments for **floating objects**

- figure
- table

1. Figures and Page Layout

Figures in \LaTeX

Example:

```
\begin{figure}[t]
  \centering
  [place image here]

  \caption{Write an (ideally self-contained) caption here.}
  \label{fig:exampleFigure}
\end{figure}
```

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- you already know labels (do this after the caption!)
- 🔗 some \LaTeX commands are “fragile” and require `\protect` in captions

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Page Breaks

You sometimes need to manually do page breaks

- during drafting a document to have sections start on new page
- when finalizing the layout and no longer modifying contents

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`\clearpage`

- prints all floating objects not output yet
- starts a new page

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`\cleardoublepage`

- starts on a new odd (right) page in double-sided layout

1. Figures and Page Layout

Footnotes

Footnotes¹ are annotations to the text that show up on the bottom of the page.

- additional information that would interrupt the flow of the text
- sometimes (usually not in the natural sciences) used for literature references
- use with care²
- don't use footnotes in presentations (as I did here)

¹such as this one

²If it is important, include it in the text. If it is not important, skip it. Only if it is neither, use a footnote.

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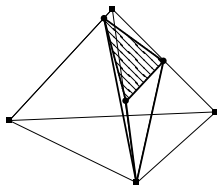
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1. Figures and Page Layout

Background on Graphic File Formats



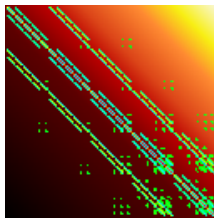
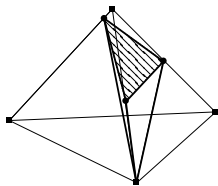
pdf^LA^TE_X can deal with three image formats:

.pdf for vector graphics

- consists of geometric objects, smooth representation
- useful for sketches and plots

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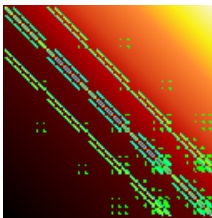
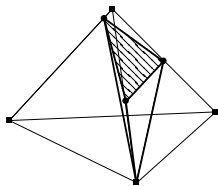
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.png for pixel graphics (small squares of constant color)

- lossless compression
- useful e.g. for scanned “line art”

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pdfL^AT_EX can deal with three image formats:

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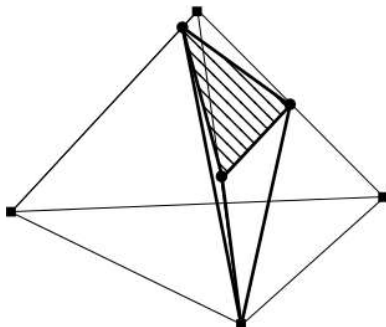
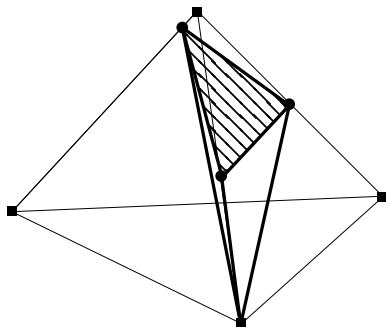
- lossless compression
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.jpg for pixel graphics (lossy compression)

- useful for photos (jpeg stands for “Joint Photographic Experts Group”)

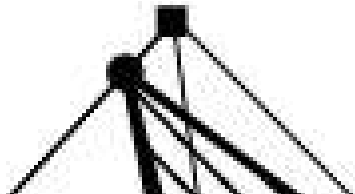
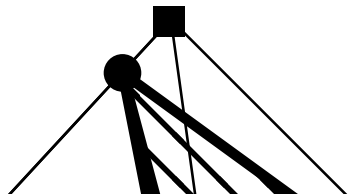
1. Figures and Page Layout

JPEG Artifacts



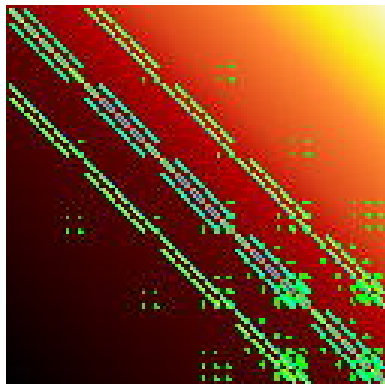
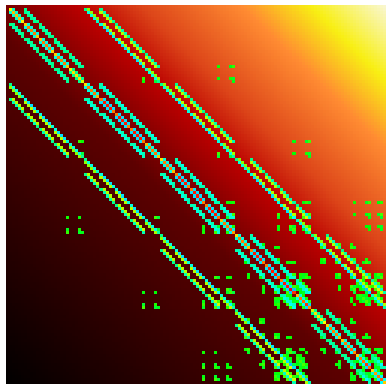
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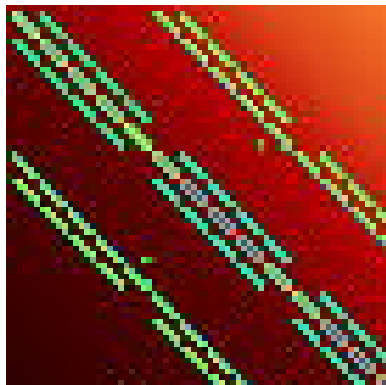
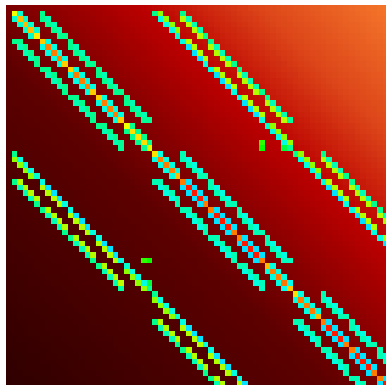
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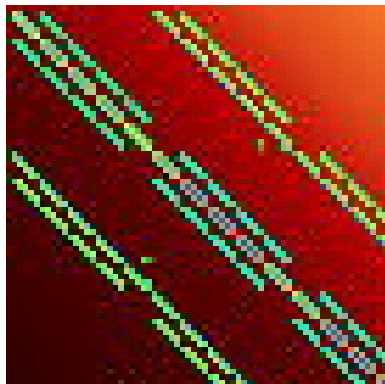
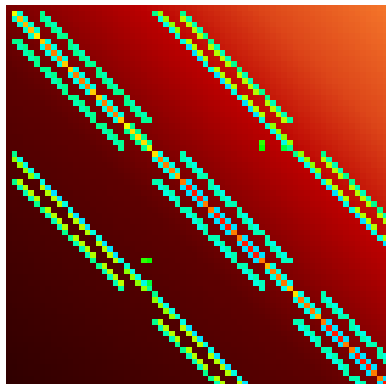
1. Figures and Page Layout


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JPEG Artifacts



 use appropriate file formats

1. Figures and Page Layout

Including Graphics in \LaTeX

- in preamble

```
\usepackage{graphicx}
```

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- specify width (`width=8cm`) or height (`height=6cm`)
- specifying both may aspect ratio
- crop image when including (`trim= 0mm 5mm 5mm 0mm`, `clip=true`)
trim: left bottom right top (counter-clockwise)

1. Figures and Page Layout

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trim: left bottom right top (counter-clockwise)
- rotate image (`angle=45`)

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Example With Poor Layout

Country	Capital City	Area	Continent
Afghanistan	Kabul	652,230 km ²	Asia
Albania	Tirana	28,748 km ²	Europe
Algeria	Algiers	2,381,741 km ²	Africa
Andorra	Andorra La Vella	468 km ²	Europe

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- consists of rows and columns
- first row and column may be of “headline”-type
- column alignment
- lines

1. Figures and Page Layout

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Recommendations

- use appropriate alignment (left/right, centered is rarely useful)
- avoid vertical lines
- use few horizontal lines
- units can go in table heading

1. Figures and Page Layout

Tables in \LaTeX

```
\begin{tabular}{llrl}  
  Country      & Capital City      & Area in km2 & Continent \\  
  Afghanistan & Kabul             & 652,230      & Asia      \\  
  Andorra     & Andorra La Vella & 468          & Europe    \\  
  [...]      &                   &              &           \\  
\end{tabular}
```

- tabular environment with column alignment

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- tabular environment with column alignment
 - l left, r right

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 - l left, r right
 - c centered, | vertical line (use with care)

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[...]  
\end{tabular}
```

- `tabular` environment with column alignment
 - `l` left, `r` right
 - `c` centered, `|` vertical line (use with care)
- `&` separates columns in one row

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- `\\` separates rows

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  [...]      &                   &              &           \\  
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```

- `tabular` environment with column alignment
 - `l` left, `r` right
 - `c` centered, `|` vertical line (use with care)
- `&` separates columns in one row
- `\\` separates rows
- you can, but don't need to align the `&` and `\\` in your input

1. Figures and Page Layout

Nice Tables in \LaTeX

```
\begin{tabular}{llrl}  
  \toprule  
  Country      & Capital City      & Area in km2 & Continent \\ \midrule  
  Afghanistan & Kabul              & 652,230      & Asia      \\ \midrule  
  Andorra     & Andorra La Vella & 468           & Europe    \\ \bottomrule  
\end{tabular}
```

- this requires `\usepackage{booktabs}` in the preamble
- three types of rules available

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Vectors and Matrices \LaTeX

$$\begin{pmatrix} a & b \\ c & d \end{pmatrix} \tag{1}$$

- structure-wise, matrices are “mathematical tables”

```
\left(  
  \begin{array}{cc}  
    a & b \\  
    c & d  
  \end{array}  
\right)
```

- `&` and `\\` work as before
- they are usually put in brackets
 - ✗ could use `\left(, \right)`
 - ✓ there is a more convenient possibility

1. Figures and Page Layout

AMS Vectors and Matrices

```
\usepackage{amsmath}
```

provides the `pmatrix` and `bmatrix` environments

$$\begin{pmatrix} a & b \\ c & d \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} \quad \begin{bmatrix} a & b \\ c & d \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} \quad (2)$$

```
\begin{pmatrix}
```

```
  a & b \\  
  c & d
```

```
\end{pmatrix}
```

```
\begin{pmatrix}
```

```
  x \\  
  y
```

```
\end{pmatrix}
```

```
\end{pmatrix}
```

- no alignment specification necessary
- again, `&` and `\\` are used

1. Figures and Page Layout

Alignment in Equations

Instead of the `equation` environment, use `align`
(also provided by the `amsmath` package)

$$A_{\text{total}} = 2 \cdot A_{\text{cap}} + A_{\text{side}} \tag{3}$$

$$= 2 \cdot \pi r^2 + 2\pi r l \tag{4}$$

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\end{align}
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\begin{align}
  A_{\text{total}} &= 2 \cdot A_{\text{cap}} + A_{\text{side}} \\
  &= 2 \cdot \pi r^2 + 2 \pi r l
\end{align}
```

- again, `&` and `\\` are used
- see `amsmath` documentation for other environments
- don't use `eqnarray`

1. Figures and Page Layout

Cases in Equations

The Heaviside function³ is defined as

$$H(x) = \begin{cases} 0 & x < 0 \\ 1 & x \geq 0 \end{cases} \quad (5)$$

³named after the British mathematician and physicist Oliver Heaviside, 1850–1925)

1. Figures and Page Layout

Cases in Equations

The Heaviside function³ is defined as

$$H(x) = \begin{cases} 0 & x < 0 \\ 1 & x \geq 0 \end{cases} \quad (5)$$

this uses the `cases` environment

```
H (x) =  
\begin{cases}  
  0 & x < 0 \\  
  1 & x \ge 0  
\end{cases}
```

- once more, `&` and `\\` are used

³named after the British mathematician and physicist Oliver Heaviside, 1850–1925)

2. Bibliographies

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2. Bibliographies

Introduction

What is a bibliography?

- list of other peoples' work your article/thesis/. . . is based on

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2. Bibliographies

Introduction

What is a bibliography?

- list of other peoples' work your article/thesis/... is based on
- cited in the text: Fermat's Last Theorem [42] states ...
- printed usually at the end of the document

Example

Fermat's Last Theorem [1] states that no three positive integers can satisfy the equation $a^n + b^n = c^n$ for integer n greater than two.

[1] Andrew Wiles. Modular elliptic curves and Fermat's last theorem. *The Annals of Mathematics*, 141(3):443–551, 1995.

2. Bibliographies

Formatting

Things that need to be consistent

- format of citations in the text

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Things that need to be consistent

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 - Fermat's Last Theorem [42] states ...
 - the experimental procedure described in [Mi86] and [DCT⁺05] ...
 - an overview is given in (Miller et al. 2003)

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and you don't want to do that manually for 100+ references

2. Bibliographies

BibTeX and L^AT_EX

Separate files

- the .tex file
 - your document
 - `\cite{name}` literature

2. Bibliographies

Bib_TE_X and L_AT_EX

Separate files

- the `.tex` file
 - your document
 - `\cite{name}` literature
- a `.bib` file
 - database of literature
 - contains entries identified by `name`
 - can be reused for other documents

2. Bibliographies

Bib_TE_X and L_AT_EX

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 - your document
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- a `.bib` file
 - database of literature
 - contains entries identified by `name`
 - can be reused for other documents
- a bibliography style
 - different ones provided by your L_AT_EX distribution
 - defines how citations should look and be sorted

2. Bibliographies

BibTeX and L^AT_EX Usage

- in the text, write things like
Fermat's Last Theorem~\cite{Wil1995} states that
- at the end of the document, write
`\bibliographystyle{plain}`
`\bibliography{literature}`
- the file `literature.bib` needs to contain an entry `Wil1995`

2. Bibliographies

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```
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Fermat's Last Theorem [1] states that no three positive integers can satisfy the equation $a^n + b^n = c^n$ for integer n greater than two.

[1] Andrew Wiles. Modular elliptic curves and Fermat's last theorem. *The Annals of Mathematics*, 141(3):443–551, 1995.

2. Bibliographies

BibTeX and L^AT_EX Work Flow

Need a two-step procedure (usually done by your editor)

2. Bibliographies

Bib \TeX and \LaTeX Work Flow

Need a two-step procedure (usually done by your editor)

- run pdf \LaTeX to write out which citations are needed
- run bib \TeX to extract, format and sort entries of bibliography
- run pdf \LaTeX again to input citations and print bibliography
- [??] and bib \TeX error messages indicate missing entries

2. Bibliographies

Bib \TeX Literature Databases

Different types of literature represented by different bib \TeX entry types

- article
- book
- inproceedings
- phdthesis
- etc.

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Use a systematic way to name the entries, e.g. FirSecThiYYYY

2. Bibliographies

Bib \TeX Literature Databases

Different types of literature represented by different bib \TeX entry types

- article
- book
- inproceedings
- phdthesis
- etc.

Use a systematic way to name the entries, e.g. FirSecThiYYYY

💡 Pay attention to your bibliography, even if that is a boring task!

“If this author did not even manage to copy bibliographic information, what can I expect from the rest?”

2. Bibliographies

BibTeX Entry: Article Example

```
@ARTICLE{AdaBreHu2003,  
  author = {Adams, Mark and Brezina, Marian and Hu, Jonathan  
           and Tuminaro, Ray},  
  title = {Parallel Multigrid Smoothing: Polynomial versus  
          {G}auss-{S}eidel},  
  journal = {Journal of Computational Physics},  
  year = {2003},  
  volume = {188},  
  pages = {593--610},  
  number = {2},  
}
```

- author format is {LastName, FirstName and OtherLastName, OtherFirstName}
- bibstyle may abbreviate first names, database should contain complete names
- title may be converted to lower case (unless enclosed in {G})

2. Bibliographies

BibTeX Entry: Book Example

```
@BOOK{All2002,  
  title = {Shape Optimization by the Homogenization Method},  
  publisher = {Springer-Verlag},  
  year = {2002},  
  author = {Allaire, Gr{\'}{e}goire},  
  volume = {146},  
  series = {Applied Mathematical Sciences},  
  address = {New York},  
  isbn = {0-387-95298-5}  
}
```

- accents etc. should be entered in L^AT_EX syntax and/or carefully checked
- imagine the cited person reads your thesis and you got the name wrong ...
- ISBN ignored by many bibstyles, but useful nonetheless

2. Bibliographies

BibTeX Entry: Inproceedings Example

```
@INPROCEEDINGS{BerEppGil1990,  
  author = {Bern, Marshall and Eppstein, David and  
           Gilbert, John},  
  title = {Provably Good Mesh Generation},  
  booktitle = {Proceedings of 31st Annual Symposium  
              on Foundations of Computer Science},  
  year = {1990},  
  pages = {231--241},  
  doi = {10.1109/FSCS.1990.89542}  
}
```

- doi ignored by many bibstyles, but very useful (e.g. allows clickable hyperlink)

2. Bibliographies

BibTeX Entry: PhDThesis Example

```
@PHDTHESIS{Dua1996,  
  author = {Duarte, Carlos Armando},  
  title = {The  $\$hp\$$  cloud method},  
  school = {University of Texas at Austin},  
  year = {1996}  
}
```

- formulas in titles etc. can be used

2. Bibliographies

BibTeX Entry: Misc Example

```
@MISC{AruBroTit2012,  
  title={Best Practices for Scientific Computing},  
  author={Aruliah, D. A. and Brown, C. Titus and  
    Hong, Neil P. Chue and others},  
  note={arXiv preprint 1210.0530v2},  
  year={2012}  
}
```

- misc can be used for “not officially published” material
- “and others” may appear as et al.

2. Bibliographies

Bibliography Entries and Files

- some publishers provide bib entries for their journals (of variable quality)

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- some publishers provide bib entries for their journals (of variable quality)
- google scholar (cite, import into BibTeX) provides bib entries
 - check capitalization
 - add DOI if available

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Bibliography Entries and Files

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- google scholar (cite, import into BibTeX) provides bib entries
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 - add DOI if available
- rather than editing bib files manually, try jabref (after this course)
 - table-view and graphical user interface
 - allows linking to pdf files and calling websites
 - allows you to keep track of literature you found at some point

2. Bibliographies

Jabref

The screenshot shows the JabRef application window. The main window title is "JabRef - /home/ole/MEVIS/NotesOle.svn/bibtex/lit.bib". The menu bar includes File, Edit, View, BibTeX, Tools, Web search, Plugins, Options, and Help. The toolbar contains various icons for file operations and search. The main area displays a table of bibliographic entries:

#	Bibtexkey	Author *	Title	Year	Journal	Entrytype
330	EckK2006	Eckardt and K{\l'{}o}nke	Adaptive Simulation of the Damage Behavior of...	2006		Inprocee...
331	Eck2000	Eckel	Thinking in C++	2000		Book
332	Eck1999	Eckel	Thinking in C++	1999		Book
333	EdgWil2008	Edginton and Willmann	Physiology-Based Simulations of a Pathological ...	2008	Clinical Ph...	Article
334	EdmEmd2...	Edmonson and van Emden	Interval Semantics for Standard Floating-Point ...	2008		Misc

Below the table, there is a filter bar with options: Required fields, Optional fields, General, Abstract, Review, and BibTeX source. The "Article" view is selected, showing details for the entry with bibtexkey "EipAbsVol2010":

- Author: Eipel, Christian and Abshagen, Kerstin and Vollmar, Brigitte
- Title: Regulation of hepatic blood flow: The hepatic arterial buffer response revisited
- Journal: World Journal of Gastroenterology
- Year: 2010
- Volume: 16
- Pages: 6046-6057
- Bibtexkey: EipAbsVol2010

Status: Preferences recorded.

3. Programming in \LaTeX

Contents

1. Figures and Page Layout

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4. Useful Packages and Outlook

3. Programming in \LaTeX

Defining Commands

- \LaTeX is (to some extent) a programming language
- defining your own commands is sometimes useful
 - for flexible notation
 - for repeated things

3. Programming in \LaTeX

Defining Commands

```
\newcommand{\measTC}{\psi}
```

- allows you to write `\measTC` throughout your document and change the notation at a single position

3. Programming in \LaTeX

Defining Commands

```
\newcommand{\measTC}{\psi}
```

- allows you to write `\measTC` throughout your document and change the notation at a single position

```
\newcommand{\fPRef}[1]{Figure~\ref{#1} on page~\pageref{#1}}
```

- see `\fPRef{fig:testPlot}` results in “see Figure 2.3 on page 42”

3. Programming in \LaTeX

Redefining Commands

```
\renewcommand{\thepage}{-- \roman{page} --}
```

- `\renewcommand` changes existing command

3. Programming in L^AT_EX

Redefining Commands

```
\renewcommand{\thepage}{-- \roman{page} --}
```

- `\renewcommand` changes existing command
- `\thepage` prints the page number on each page
more commands starting with `\the` exist

3. Programming in L^AT_EX

Redefining Commands

```
\renewcommand{\thepage}{-- \roman{page} --}
```

- `\renewcommand` changes existing command
- `\thepage` prints the page number on each page
more commands starting with `\the` exist
- `page` (note the missing backslash) is a counter

3. Programming in L^AT_EX

Redefining Commands

```
\renewcommand{\thepage}{-- \roman{page} --}
```

- `\renewcommand` changes existing command
- `\thepage` prints the page number on each page
more commands starting with `\the` exist
- `page` (note the missing backslash) is a counter
- `\roman` prints a counter in roman numerals

3. Programming in \LaTeX

Defining Commands

Another example: including all of your (many) plots with the same size.

3. Programming in \LaTeX

Defining Commands

Another example: including all of your (many) plots with the same size.

```
\newcommand{\includePlot}[3]{%
  \begin{figure}
    \centering
    \includegraphics[width=0.4\textwidth]{plots/#1}

    \caption{#2}\label{#3}
  \end{figure}
}
```

3. Programming in L^AT_EX

Defining Commands

Another example: including all of your (many) plots with the same size.

```
\newcommand{\includePlot}[3]{%  
  \begin{figure}  
    \centering  
    \includegraphics[width=0.4\textwidth]{plots/#1}  
  
    \caption{#2}\label{#3}  
  \end{figure}  
}
```

Use Command

- `\includePlot{inputPlot.pdf}{Measured inflow concentration to aquarium}{fig:inputPlot}`
- `\includePlot{outputPlot.pdf}{Measured outflow concentration from aquarium}{fig:outputPlot}`
- `\includePlot{weightPlot.pdf}{Estimated weight of fish }{fig:weightPlot}`

3. Programming in \LaTeX

Working with Big Documents

- usually no problem to work on documents with 100s of pages
- you can put separate parts (sections, chapters, ...) in separate files

```
\documentclass{article}
\begin{document}
\input{introduction.tex}
\input{materialAndMethods.tex}
\input{results.tex}
\end{document}
```

4. Useful Packages and Outlook

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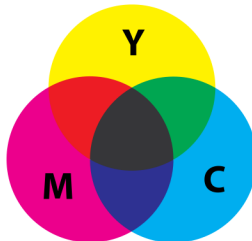
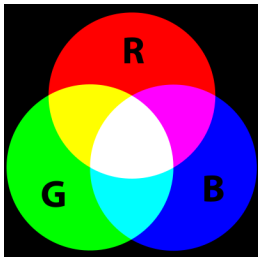
4. Useful Packages and Outlook

4. Useful Packages and Outlook

Color

Technical Background

- monitors and projectors (additively) mix red, green, and blue (RGB)
- printers (subtractively) mix cyan, magenta, yellow, black (CMYK)



images from <http://en.wikipedia.org/wiki/File:AdditiveColor.svg> and <http://en.wikipedia.org/wiki/File:SubtractiveColor.svg>, public domain

4. Useful Packages and Outlook

Use Color With Care!

You don't know in advance

- if the reader will use a b/w printer
- if the reader is color-blind
- how color will be printed/displayed/projected

4. Useful Packages and Outlook

Use Color With Care!

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- ⚠ if the reader will use a b/w printer
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So ...

- think twice about using color in presentations
- think three times about using color for printed documents

4. Useful Packages and Outlook

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- 💡 if the reader will use a b/w printer
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So ...

- think twice about using color in presentations
- think three times about using color for printed documents

Other possibilities (in addition to or instead of color)

- use shading for areas
- solid/dashed/dotted lines, line thickness

4. Useful Packages and Outlook

Using Color in \LaTeX

`\usepackage{graphicx}` provides pre-defined colors

- `\textcolor{red}{text to be written in red}` uses color
- `\definecolor{myDarkRed}{rgb}{0.6,0.0,0.0}` defines a new color

4. Useful Packages and Outlook

Introduction to Packages

- in the preamble, use `\usepackage{something}`
- in the text, commands provided by the package can then be used
- packages usually have documentation
(or ask your favorite search engine)
- 📌 sometimes, multiple packages define the same command (order may matter)

4. Useful Packages and Outlook

Babel

`\usepackage[french]{babel}` changes language settings

- hyphenation rules
- texts like “Section”, “Table of Contents”, ...

4. Useful Packages and Outlook

Microtype

`\usepackage{microtype}`

uses some micro-typographical tricks to improve justification of text

'Margin kerning is the adjustment of the characters at the margins of a typeset text. A simplified employment of margin kerning is hanging punctuation. Margin kerning is needed for optical alignment of the margins of a typeset text, because mechanical justification of the margins makes them look rather ragged. Some characters can make a line appear shorter to the human eye than others. Shifting such characters by an appropriate amount into the margins would greatly improve the appearance of a typeset text.'

Composing with font expansion is the method to use a wider or narrower variant of a font to make interword spacing more even. A font in a loose line can be substituted by a wider variant so the interword spaces are stretched by a smaller amount. Similarly, a font in a tight line can be replaced by a narrower variant to reduce the amount that the interword spaces are shrunk by. There is certainly a potential danger of font discretion when using such manipulations, thus they must be used with extreme care. The possibility to adjust a line width by font expansion can be taken into consideration while a paragraph is being broken into lines, in order to choose better breakpoints.' (Thähn 2000, p. 323)

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Compare the right margins.

(Two screenshots from R. Schlicht: The microtype package, v2.5a.)

4. Useful Packages and Outlook

Hyperref

`\usepackage{hyperref}` enables clickable hyperlinks and other pdf features
Extended example usage:

```
\usepackage[colorlinks=true,  
  linkcolor=black,citecolor=black,urlcolor=black,  
  pdfstartview={Fit},pdfpagelayout={TwoPageRight}]{hyperref}
```

4. Useful Packages and Outlook

TikZ and PGFPlots

Drawings and plots should ideally have same font (math capabilities etc.) as the text.

- \LaTeX has built-in `picture` environment (neither convenient nor flexible)

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Drawings and plots should ideally have same font (math capabilities etc.) as the text.

- \LaTeX has built-in `picture` environment (neither convenient nor flexible)
- some tools (gnuplot, xfig, inkscape?) have \LaTeX export
 - plot/drawing as pdf file
 - \LaTeX code fragment (picture environment) that places text on top

4. Useful Packages and Outlook

TikZ and PGFPlots

Drawings and plots should ideally have same font (math capabilities etc.) as the text.

- \LaTeX has built-in `picture` environment (neither convenient nor flexible)
- some tools (gnuplot, xfig, inkscape?) have \LaTeX export
 - plot/drawing as pdf file
 - \LaTeX code fragment (picture environment) that places text on top
- better drawing and plotting from within your document via TikZ and PGFPlots

4. Useful Packages and Outlook

Other Fonts

Changing fonts inside your document is not simple (because usually you shouldn't).

- `\usepackage{mathptmx}` changes serif font to Times plus matching math font
⚠ Do this only if you're writing a newspaper or if you really have to.
- `\usepackage{helvet}` changes sans-serif font to Helvetica (Arial equivalent)
⚠ Do this only if you have to.
- `\usepackage{courier}` changes typewriter font to Courier
- `\usepackage{mathpazo}` is what I usually use (Palatino equivalent with matching math font)

4. Useful Packages and Outlook

Further Useful Packages

- for common symbols: `textcomp`, `wasysym`
- for units and prefixes: `siunitx`
- to print labels (during drafting): `showlabels`
- to print program source code listings: `listings`

4. Useful Packages and Outlook

Further Useful Packages

- for common symbols: `textcomp`, `wasysym`
- for units and prefixes: `siunitx`
- to print labels (during drafting): `showlabels`
- to print program source code listings: `listings`

For other applications, ask your favorite search engine, one of the more than 3300+ packages currently available might provide a solution.

4. Useful Packages and Outlook

Presentations: Beamer

`\documentclass{beamer}` can be used for presentations (such as this one).

Basic format of Slides

```
\begin{frame}
  \frametitle{Goal of Today's Lecture}
  \begin{itemize}
    \item non-text components of scientific texts
      [...]
  \end{itemize}
\end{frame}
```


4. Useful Packages and Outlook

Presentations: Beamer

`\documentclass{beamer}` can be used for presentations (such as this one).

Basic format of Slides

```
\begin{frame}
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  \begin{itemize}
    \item non-text components of scientific texts
      [...]
  \end{itemize}
\end{frame}
```

- format of slides very flexible
- detailed user guide available
(contains general tips and tricks for good presentations)

4. Useful Packages and Outlook

Uncovering Slides

```
\begin{frame}
  \frametitle{Background on Graphic File Formats}
  \begin{center}
    \visible<1->{\includegraphics{example-pdf-picture}}
    \visible<2->{\includegraphics{example-png-picture}}
  \end{center}

  \begin{itemize}
    \item .pdf for vector graphics\pause
    \item .png for pixel graphics
  \end{itemize}
\end{frame}
```

4. Useful Packages and Outlook

Further Reading

- Tobias Oetiker, Hubert Partl, Irene Hyna and Elisabeth Schlegl: [The not so short introduction to L^AT_EX 2_ε](#) (search for l2short.pdf)
A general introduction to using L^AT_EX
- Markus Kohm, Jens-Uwe-Morawski: [KOMA-Script, a versatile L^AT_EX 2_ε bundle](#) (search for scrguien.pdf)
A detailed manual of different document classes with quite some typographical background
- Till Tantau, Joseph Wright, Vedran Miletić: [The beamer class](#) (search for beameruserguide.pdf)
A detailed manual how to create presentations using L^AT_EX with tips and tricks for good presentations
- Till Tantau: [The TikZ and PGF Packages](#) (search for pgfmanual.pdf)
A detailed manual on generating drawings in L^AT_EX
- Christian Feuersänger: [Manual for Package pgfplots](#) (search for pgfplots.pdf)
A detailed manual on creating plots
- Scott Pakin: [The Comprehensive L^AT_EX Symbol List](#) (search for symbols-a4.pdf)