Instructions for FEniCS book authors

November 1, 2010

General instructions

- Carefully read the comments from the referees and editors, and update your chapter accordingly. Send a detailed response to the referee comments along with your revised chapter.
- Make sure to run a spell-checker (American English) before you submit your chapter.
- Make sure that all references are complete and accurate and that your chapter compiles without warnings.
- Submit your book chapter as a patch against the latest book repository. Note that the style files for the book have changed, so changes should be made relative to the latest version of your chapter in the book repository (not your local copy). Note that your chapter may already have gone through some minor modifications in order to compile against the new style files.
- Check that you have referenced all figures in your chapter and that the figures look good. Avoid adding very large image files (in MB).
- Along with your submission, supply a short text for your affiliation, including your email address and any funding acknowledgments. Your affiliation will be added to an appendix of the book that lists the affiliations of all authors.
- Make sure to browse through all other chapters and add appropriate references to other relevant chapters.
- Each chapter should begin with a short 1–2 paragraph pre-intro that introduces the chapter. Chapters should not have a first section named "Introduction".

Specific typesetting instructions

- Avoid excessive use of LaTeX macros in chapters. Not only does it complicate editing if for example `\begin{itemize}` is replaced by `\bit`, but it may also conflict with macros defined in other chapters. If it is necessary to define macros, then prefix the macros with the chapter prefix, or ask the editors to add them globally.
- Justify your text (line-breaking) and make sure it looks clean. In Emacs, this can be handled by `M-x auto-fill-mode` or pressing `M-q` on each paragraph.
- Use `~` in references and citations: `... in~\ref{...}`, `... in~\cite{...}`.
- Chapters should be referred to using `Chapter~\ref{chap:prefix}`, where `prefix` is the chapter prefix.
- Use `\eqref{}` to refer to equations. A typical usage would be:

  ```
  It follows from~\eqref{eq:hoffman-1:ns} that....
  ```

- All chapter labels should be prefixed with the type of label and the chapter prefix, for example `fig:hoffman-1:foo` or `tab:narayanan:bar`.
- Use the environments `\begin/end{python}` and `\begin/end{c++}` to typeset Python and C++ code.
- The book must be built using `pdflatex` (to work with the new style files). This means that EPS figures can no longer be used. Instead, PDF figures should be used. All EPS figures in the book repository have been converted to PDF using `epstopdf`, which preserves vector graphics. Make sure all images in your chapter are supplied as PDF files and, where possible, in a scalable vector graphics format (no bitmaps). It follows that `\psfrag{}` can no longer be used so all images that rely on `\psfrag{}` must be replaced by appropriate PDF images.
- Supply original image files (SVG) where possible to enable editing of images if this becomes necessary.
- Use Inkscape to draw figures. You can use one of the SVG files from chapter [kirby-6] as a template for line widths and colors.
- Where possible, use `width=\smallfig` or `width=\largefig` to specify image sizes.
- Place image files in subdirectories named `pdf`, `svg` etc. inside the chapter subdirectory.
- Use `$...$` for inline math, not `\(...\)`. Use of `\(...\)` in captions breaks the new style files.

- Don't put `\label{...}` inside `\caption{...}`. This breaks the new style files.
- Titles of chapters, sections etc. should *not* be capitalized (with the exception of names and the first letter).
- Only number referenced equations. Use `\begin/end{displaymath}` or `\begin/end{equation*}` until you find out that you actually need to reference an equation.
- Use *subcomponent*, *subelement* instead of *sub component*, *sub element* etc., cf. `http://www.thefreedictionary.com/subcomponent`.
- Use `\index{}` to include important terms in the book index.
- Consider the list of variable names given below and try to follow it where possible.

Notation

- The order of test and trial functions has changed. The canonical variational is now $a(u, v) = L(v)$. Generally, we write:

$$F(f_1, \cdots, f_m; v_0, \ldots, v_n) \tag{1}$$

  for a form F that is linear in the variables $v_1, \ldots, v_m$ (and non-linear in the variables $f_1, \ldots, f_m$.)
- Second, the name of a cell/element has changed from K to T.
- Don't use bold fonts unless really, really required. In particular, do not use bold fonts (nor super-imposed bars/arrows) to denote vector fields.
- Use either grad, curl, div or ∇, $\nabla\times$, $\nabla\cdot$, and make sure to follow the new row-wise notation used in UFL, that is, $(\text{grad}\, v)_{ij} = \partial v_i/\partial x_j$ and $(\text{div}\, v)_i = \partial v_{ij}/\partial x_j$. Macros `\Grad`, `\Div`, `\Curl` can be used.
- Use $\mathrm{d}x$ for integration, not $\mathrm{d}\Omega$.
- Write the nonlinear term in Navier–Stokes as $\text{grad}u \cdot u$ or $\nabla u \cdot u$.

Function spaces

$H^1(\Omega)$	–	the Sobolev space $W^{1,2}(\Omega)$
$H^1_0(\Omega)$	–	the Sobolev space $W^{1,2}(\Omega)$, zero boundary trace
$[H^1(\Omega)]^n$	–	the Sobolev space $W^{1,2}(\Omega)$, vector-valued with n components
$\mathrm{CG}_q(\Omega)$	–	continuous piecewise polynomial function space of degree q
$\mathrm{DG}_q(\Omega)$	–	discontinuous piecewise polynomial function space of degree q

Operators

$\lvert \cdot \rvert$	–	$\mathbb{R}^n$ norm
$\langle v, w \rangle$	–	inner product, use macro `\inner`
$\lVert \cdot \rVert_V$	–	if V is a normed space: norm on space V
$\lVert \cdot \rVert_K$	–	if K is a domain: $L^2(K)$ norm
$\lVert \cdot \rVert$	–	defaults to $L^2(\Omega)$ norm
$\lVert \cdot \rVert_0$	–	also $L^2(\Omega)$ norm
$\lVert \cdot \rVert_1$	–	$H^1(\Omega)$ norm
$\lVert \cdot \rVert_{\mathrm{div}}$	–	$H(\mathrm{div})$ norm
$\lVert \cdot \rVert_{\mathrm{curl}}$	–	$H(\mathrm{curl})$ norm
$[\![v]\!]$	–	jump, use macro `\jump`
$\langle v \rangle$	–	average, use macro `\avg`

Names of variables

A	–	the *global tensor* with entries $\{A_i\}_{i \in \mathcal{I}}$
A_T	–	the *element tensor* with entries $\{A_{T,i}\}_{i \in \mathcal{I}_T}$
A^0	–	the *reference tensor* with entries $\{A^0_{i\alpha}\}_{i \in \mathcal{I}_T, \alpha \in \mathcal{A}}$
a	–	a multilinear form
a_T	–	the local contribution to a multilinear form a from a cell T
$\mathcal{A}$	–	the set of *secondary indices*
$\mathcal{B}$	–	the set of *auxiliary indices*
F_T	–	the mapping from the reference cell T_0 to T
G_T	–	the *geometry tensor* with entries $\{G^\alpha_T\}_{\alpha \in \mathcal{A}}$
$\mathcal{I}$	–	the set $\prod_{j=1}^{\rho}[1, N_j]$ of indices for the global tensor A
$\mathcal{I}^T$	–	the set $\prod_{j=1}^{\rho}[1, n^T_j]$ of indices for the element tensor A^T (*primary indices*)
ι_T	–	the *local-to-global mapping* from $[1, n_T]$ to $[1, N]$
T	–	a *cell* in the mesh $\mathcal{T}$
T_0	–	the *reference cell*
n	–	unit normal vector (to boundary)
t	–	unit tangential vector (to boundary)
L	–	a linear form (functional) on $\hat{V}$ or $\hat{V}_h$
b	–	a *global* right-hand side vector, corresponding to $L(\phi_i)$
$\mathcal{L}$	–	the degrees of freedom (linear functionals) on V_h
$\mathcal{L}_T$	–	the degrees of freedom (linear functionals) on $\mathcal{P}_T$
$\mathcal{L}_0$	–	the degrees of freedom (linear functionals) on $\mathcal{P}_0$
ℓ_i	–	a degree of freedom (linear functional) on V_h
ℓ^T_i	–	a degree of freedom (linear functional) on $\mathcal{P}_T$
ℓ^0_i	–	a degree of freedom (linear functional) on $\mathcal{P}_0$
$\mathcal{P}_q(T)$	–	the space of polynomials of degree $\leq q$ on a domain T
u	–	the exact solution of a variational problem, $u \in V$
u_h	–	the finite element solution, $u_h \in V_h$
U	–	the vector of degrees of freedom for $u_h = \sum_{i=1}^{N} U_i \phi_i$
V	–	the trial space

$\hat{V}$	–	the test space
V^*	–	the dual space (as in duality-based error analysis) of a space V
V_h	–	the discrete trial space
$\hat{V}_h$	–	the discrete test space
ϕ_i	–	a basis function in V_h
$\hat{\phi}_i$	–	a basis function in $\hat{V}_h$
$\mathcal{T}_h$	–	the *mesh*, $\mathcal{T}_h = \{T\}$
Ω	–	a bounded domain in $\mathbb{R}^d$
$\partial\Omega$	–	the boundary of Ω
k_n	–	time step
I_n	–	time interval of length $k_n - k_{n-1}$
u_{hk}	–	the finite element solution in space-time
S_n	–	space-time slab $\mathcal{T} \times I_n$
$\mathrm{d}x$, $\mathrm{d}s$, $\mathrm{d}t$	–	integration, use macros `\dx`, `\ds`, `\dt`
X	–	coordinates in a reference frame
x	–	coordinates in a physical space