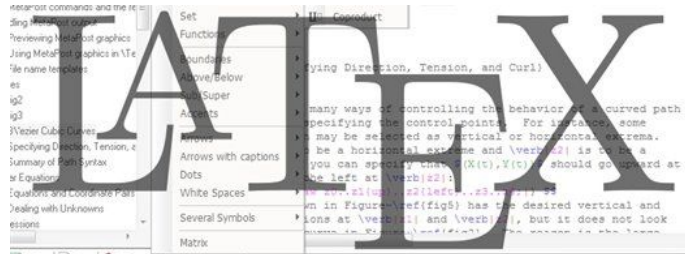


# LaTeX Lab: Auctex

2.680 Unmanned Marine Vehicle Autonomy, Sensing, and Communications



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# 1 Overview and Objectives

This lab provides an introduction to using Auctex to simplify L<sup>A</sup>T<sub>E</sub>X editing.

## 1.1 Objectives

When finished with this lab, you will have completed the following objectives:

- code a basic LaTeX document using provided templates including
  - create a title page
  - create an abstract
  - create a table of contents

## 1.2 Deliverables

You will complete the following deliverables at the completion of this lab:

1. produce a LaTeX-based document using the provided templates and references.

## 1.3 What you will need to get started

You will need a machine that has:

- Emacs as a text editor.
- The `pdflatex` compiler installed. In this lab, we assume the compiler is the executable `pdflatex`.

## 2 Basic LaTeX References

This section is provided for your easy of reference only. You may proceed to the next section.

### 2.1 Online Documentation

Some basics for LaTeX documents maybe found at the following links:

1. <https://en.wikibooks.org/wiki/LaTeX/>
2. [http://latex.wikia.com/wiki/Main\\_Page](http://latex.wikia.com/wiki/Main_Page)
3. <https://www.sharelatex.com/>

Additionally, you may find the following book helpful for more advanced concepts:

- *Tex Unbound: Latex & Tex Strategies for Fonts, Graphics, & More: LaTeX and TeX Strategies for Fonts, Graphics, and More* by Alan Hoenig (1998-01-01); Publisher: Oxford University Press USA; ASIN: B01K0SZJOS.

### 2.2 Additional Documentation

Some additional references that are recommended are found below.

**LaTeX Quick Reference** [http://oceanai.mit.edu/k\\_w/latex\\_lab/refs/latex.pdf](http://oceanai.mit.edu/k_w/latex_lab/refs/latex.pdf)

**LaTeX Cheat Sheet** [http://oceanai.mit.edu/k\\_w/latex\\_lab/refs/latexsheet.pdf](http://oceanai.mit.edu/k_w/latex_lab/refs/latexsheet.pdf)

**Auctex Reference Card** [http://oceanai.mit.edu/k\\_w/latex\\_lab/refs/auctex.pdf](http://oceanai.mit.edu/k_w/latex_lab/refs/auctex.pdf)

**Auctex Manual** <https://www.gnu.org/s/auctex/manual/auctex.pdf>

### 2.3 Creating a Basic LaTeX Document

Complete the following steps to create, edit, compile, and open a basic LaTeX document.

1. create a new file (myfile.tex) using emacs
2. edit the file and insert the basic LaTeX document structure. Save the file frequently.

*Listing 1: LaTeX File Structure.*

```
0 \documentclass[onecolumn,letterpaper,11pt]{article}
1 % Insert any packages, environments, counters, etc. here
2 \begin{document}
3 % Insert your document contents here
4 Hello world!
5 \end{document}
```

3. compile the LaTeX document (command line sequence, makefile, then using Auctex shortcuts)

- (a) compile from the console using a file named myfile.tex

```
$$ pdflatex myfile; pdflatex myfile
```

- (b) compile and open from the console for a makefile named "makefile"

```
$$ make pdfo
```

*Listing 2: Example LaTeX makefile (named "makefile").*

```
.SILENT:

.PHONY : all clean

LATEX      = pdflatex
PAPER      = myfile #name of main file without ``.tex''

main: $(PNGFILES)
    $(LATEX) $(PAPER)
    bibtex $(PAPER) # if using a bibliography
    $(LATEX) $(PAPER)

pdfo: main # opens paper after compiling
    open $(PAPER).pdf &

pdfoq:     # opens paper after single compile
    $(LATEX) $(PAPER)
    open $(PAPER).pdf &

pdfv:     # only opens paper
    open $(PAPER).pdf &

clean:    # cleans files made while compiling
    rm -f $(PAPER).dvi *~ $(PAPER).log $(PAPER).pdf $(PAPER)
).ind
    rm -f $(PAPER).bbl $(PAPER).blg $(PAPER).ps $(PAPER).aux
    rm -f $(PNGFILES) $(PAPER).toc $(PAPER).idx $(PAPER).ilg
    rm -f $(LDIR)*.bak $(LDIR)*~ $(PAPER).adx $(PAPER).and
    rm -f $(PAPER).out $(PAPER).lot $(PAPER).lof
```

- (c) from the emacs editor with Auctex installed (Section 3.2), use either of the following shortcuts:

```
C+c C+c <RETURN> (<- this compiles; note, will need to run multiple times)
# OR #
C+c C+a <RETURN> (<- this compiles and opens)
```

4. open the resulting PDF (tip: keeping the PDF file open next to your editor allows for quickly viewing changes after each compile. Most editors will refresh with the current view and location of the document. If using Mac, consider using the Skim PDF viewer if Preview returns you to the beginning of the document after each compilation.)

## 3 Advanced (and Easier!) LaTeX Editing with Auctex and Emacs

Emacs24 and newer gives significant functionality when editing .tex files when the Auctex and Reftex modes are enabled. Ensure you have upgraded to Emacs24 or newer (mac users, this can be found using mac ports).

### 3.1 Emacs

See the lab for surviving emacs:

<http://oceanai.mit.edu/ivpman/pmwiki/pmwiki.php?n=Help.EmacsQuick>

Once you have an understanding of navigating Emacs, it is important to reference the emacs shortcuts. An additional package that can be installed in Emacs to enable shortcuts specific to editing LaTeX documents is Auctex (Section 3.2).

### 3.2 Auctex

Auctex provides the macros, shortcuts, and interface for efficiently editing LaTeX documents with Emacs. Once you have mastered this lab, you may desire to customize Auctex. You make do that by modifying your init.el file. There is a helpful resource including an init.el sample to set up auctex and reftex here: <http://tex.stackexchange.com/questions/50827/a-simpletons-guide-to-tex-workflow-with-emacs>

#### 3.2.1 Installation

1. M-x list-packages RET
2. mark the auctex package for installation with i
3. hit x to execute the installation procedure

Auctex only needs a small amount of information at the end of the file to know where to look for other files and what sort of file it is. Auctex looks for the following template at the end of your emacs file. Include the following as the last lines in your .tex file. The only thing you need to change is the name of the file name (here, mainfilename.tex). Note that the % and \* characters are required.

*Listing 3: Auctex File Footer.*

```
%%% Local Variables: ***
%%% mode:latex ***
%%% TeX-master: "mainfilename.tex" ***
%%% End: ***
```

Let's see just how easy creating a new document with Auctex is. In fact, the four lines at the end of the file will be inserted automatically. Try the following:

1. C-x C-f RET
2. enter a file name (test.tex)

3. at the prompt for master file, press RET to default to itself (this would be different if you were adding a chapter to a thesis, for example).
4. notice that the style hooks are now applied
5. save your file: C-x C-s
6. add the document environment
  - note: emacs commands often begin with the keys C-x. Auctex commands often start with C-c.
  - press C-c C-e to add an environment
7. note that the default is document since we don't have one yet. Press RET.
8. Auctex is now searching for document classes. To see a list, press ?. To default to article, press RET.
9. Now Auctex asks what options you want to add. If none, press RET. If you want to know what options you have, press ?. Press ?. Type "one" and push TAB. You'll see the list update to two options. Type "c" and TAB. "Onecolumn" is selected. Press RET.
10. The packages option now appears. Press "?" to see the options. Press RET to continue without any packages for now.
11. Auctex returns you to the editing screen and you are ready to make your file!
12. Type "hello world"
13. save your file: C-x C-s
14. compile and open your document: C-c C-a
15. that's it!

Once you are comfortable with the shortcuts and setup for Auctex, use Reftex to give more power with citations and bibliographies. (That's the next lab!)

### 3.2.2 Basic Auctex Shortcuts

Several basic shortcuts exist for using Auctex in emacs to edit LaTeX documents. These shortcuts enable fast insertion of macros as well as quick referencing to other features. With some practice, creating a document in LaTeX can easily be faster than its equivalent in a word processor such as Microsoft Word, especially when making lists or writing complex equations. The latest shortcuts and macros can be found here: <http://tex.stackexchange.com/questions/20843/useful-shortcuts-or-key-bindings-or-predefined-commands-for-emacs-auctex>

## 4 Auctex Examples

### 4.1 Formatting Text

Let's see how easy it is to format some text. We will use the Hello World file that we just created. In the Hello World file, insert a second paragraph of text. We will use the paragraph that you are reading right now for the example.

First, highlight the word “easy”. We will make this a **bold face**. With “easy” highlighted, press C-c C-f C-b. That's it! The C-c C-f command will put us into a font editing state. If you highlight the word “format” in your tex document, then press C-c C-f ?, you will see a list of options for formatting. The key sequence in the KEY column is the third key combination in the series if you desire that font effect. For example, if we highlighted the word “format” and pressed C-c C-c C-e, we would make format *emphasized*.

Other shortcuts from the font menu include SMALL CAPS, `typewriter`, etc. Note that the MATH-FONT column tells you what the key combination would do if you were in a math mode (for example, between dollar signs or in an align environment).

Save and compile your document to view the changes (C-c C-a). The solution is here: [http://oceanai.mit.edu/k\\_w/latex\\_lab/lab\\_8\\_example\\_formatting\\_text.tex](http://oceanai.mit.edu/k_w/latex_lab/lab_8_example_formatting_text.tex)

### 4.2 Inserting Environments

Inserting environments can be time consuming if typing all the lines by hand. Think about the brain and finger power required the first time you created a nested list. Let's condense that down into just a couple of key strokes. Environments take the form of align, footnotes, itemized lists, etc. Most environments like this come pre-loaded in Auctex. Let's work an example.

We will continue on the file you were just editing above. Now we will add nested itemized list. Create a couple of lines of blank space at the bottom of your tex document (but before the document environment ends). Now press the following key sequence: C-c C-e RET. This will default to an itemized list (you can see the default value at the bottom of your screen just before you pushed RET. You will see that Auctex inserted the begin, item, and end fields. Your cursor is also at the correct place to write your first bullet. Type a few words next to the first item field. Now press M-RET (remember the M key is the OPTION key on a mac). Your cursor is moved to the next line and the next item field is inserted. Now type “let's make a nested list” on the second line. While at the end of your second bullet line, press C-c C-e enum TAB RET. You'll have just inserted an enumerated list nested under the second bullet of your itemized list. Type a line of text, create a second line (M-RET), and create a second line of text. Use the down key to go just below the `\end{enumerate}` line. Create your next itemized bullet with M-RET and type your third itemized bullet. That's it. Now move below the `\end{itemize}` line and continue to a new paragraph.

We've just seen how easy it is to insert list environments. Let's see what other environments are available with the key combinations. At your new paragraph location, type: C-c C-e TAB. You'll notice a list of common environments appear to make your life easier. Try inserting a footnote (C-c C-e foot TAB RET).

Next let's insert a figure (C-c C-e fig TAB RET. The first question at the prompt is float position (h,b,t,p). Enter a letter and press RET. The next prompt is the caption. Enter a short caption and



press RET. The next prompt is for centering (y or n; no RET required!). The final prompt is for a label. It already gives you the preface “fig:” so type something like “mylogo” and press RET. Now notice all the figure environment is inserted except for the “includegraphics” line. You can customize your Auctex settings to include this using the Auctex help and reference pages. There are even some great add ons that will let you do things like drag and drop an image into Auctex and have the figure blocked filled in. If you’re interested in exploring that particular one, look here: <http://emacs.stackexchange.com/questions/16318/drag-and-drop-images-to-auctex>.

### 4.3 Adding Sections

At the end of your current tex file, find a blank line. We’ll insert sections, subsections, etc. using the same set of keys: C-c C-s. After pressing this key combination, you’ll see a “level” prompt at the bottom. You may type (with tab complete) the level you want if the default is not correct. Let’s type “se” and TAB RET. Next enter a title “Introduction”. The next prompt is for a label likely already with the “sec:”. Type “intro” and press RET. Your section appears with auctex color formatting (yellow text inside the section header). We can do the same for subsections, subsections, etc. If you missed your label, you can either insert it manually, or wait until we add Reftex in the next lab.

### 4.4 Basic Math

Let’s edit some math! Insert an align environment (C-c C-e align RET. Within the align, we know how to enter basic equations from an earlier lab. Let’s quickly add some symbols and greek letters. When using Auctex, we can quickly access math symbols by using the ‘ key (above TAB without pressing SHIFT). Let’s type the following using Auctex

$$\alpha \cdot \nu \in \hat{\Pi}(x, y)$$

While this example appears as non-sense, the intention is to show the ease of writing in math mode. We’ll do it together inside your align environment with the following. Note that the “-” is never actually pressed (i.e., ‘-a means press ‘ then a). You will need to add a space between commands. Also, when done with the hat function, you’ll need to move your cursor out of the arrow before adding the left/right brackets.

*Listing 4: Auctex Equation Example.*

```
‘-a ‘-. ‘-n ‘-i ‘-^ ‘-P ‘-( SPACE x , y SPACE
```

That’s it. It might look super confusing, but let’s use the decoder ring on the auctex reference card you’ve already downloaded. Look at the far right column. There’s a great layout of symbols, greek letters, and mathematical operators. Each symbol you want has a key associated with it. For example,  $\alpha$  is listed with \alpha and “a”. To write an  $\alpha$ , we simply press the keys ‘-a. These can even be customized if you use other symbols frequently enough to justify it (see reference manual).

Interested in seeing your math appear within Auctex’s editor and not compiling the entire document? Try the preview region with C-c C-p C-r. You may need to run this twice but your math should appear as though they would be printed.

## 4.5 Closing an Environment

Let's say that you were moving quickly and forgot to use Auctex to start your environment. Let's say that you typed the following: `\begin {itemize} RET \item first line .` You may still use the M-RET to create the next item. You can also close out the environment with a shortcut. When you're done and ready to close the environment, simply type C-c ] and the end will be inserted and your cursor moved to the following line.