

# UseLATEX.cmake: L<sup>A</sup>T<sub>E</sub>X Document Building Made Easy

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## 1 Description

Compiling L<sup>A</sup>T<sub>E</sub>X files into readable documents is actually a very involved process. Although CMake comes with FindLATEX.cmake, it does nothing for you other than find the commands associated with L<sup>A</sup>T<sub>E</sub>X. I like using CMake to build my L<sup>A</sup>T<sub>E</sub>X documents, but creating targets to do it is actually a pain. Thus, I've compiled a bunch of macros that help me create targets in CMake into a file I call "UseLATEX.cmake." Here are some of the things UseLATEX.cmake handles:

- Runs L<sup>A</sup>T<sub>E</sub>X multiple times to resolve links.
- Can run bibtex, makeindex, and makeglossaries to make bibliographies, indexes, and/or glossaries.
- Optionally runs configure on your L<sup>A</sup>T<sub>E</sub>X files to replace @*VARIABLE*@ with the equivalent CMake variable.
- Automatically finds png, jpeg, eps, pdf, svg, tiff, and gif files and converts them to formats latex and pdflatex understand.

## 2 Download

UseLATEX.cmake is currently posted to the CMake Wiki at

<http://public.kitware.com/Wiki/CMakeUserUseLATEX>.

## 3 Basic Usage

Using UseLATEX.cmake is easy. For a basic L<sup>A</sup>T<sub>E</sub>X file, simply include the file in your CMakeLists.txt and use the ADD\_LATEX\_DOCUMENT command to make targets to build your document. For an example document in the file MyDoc.tex, you could establish a build with the following simple CMakeLists.txt.

```
PROJECT(MyDoc NONE)
```

```
INCLUDE(UseLATEX.cmake)
ADD_LATEX_DOCUMENT(MyDoc.tex)
```

The `ADD_LATEX_DOCUMENT` adds the following targets to create a readable document from `MyDoc.tex`:

**dvi** Creates `MyDoc.dvi`.

**pdf** Creates `MyDoc.pdf` using `pdflatex`. Requires the `PDFLATEX_COMPILER` CMake variable to be set.

**ps** Creates `MyDoc.ps`. Requires the `DVIPS_CONVERTER` CMake variable to be set.

**safepdf** Creates `MyDoc.pdf` from `MyDoc.ps` using `ps2pdf`. Many publishers prefer pdfs are created this way. Requires the `PS2PDF_CONVERTER` CMake variable to be set.

**html** Creates html pages. Requires the `LATEX2HTML_CONVERTER` CMake variable to be set.

**clean** To CMake's default clean target, the numerous files that `LATEX` often generates are added.

**auxclean** Deletes the auxiliary files from `LATEX`, but not the generated input files. Sometimes `LATEX` gets itself in a bad state where the auxiliary files need to be deleted to successfully build again, and this target does that without also deleting other build files (such as converted image files or files from unrelated targets in the same directory).

One caveat about using `UseLATEX.cmake` is that you are required to do an out-of-source build. That is, CMake must be run in a directory other than the source directory. This is necessary as latex is very picky about file locations, and the relative locations of some generated or copied files can only be maintained if everything is copied to a separate directory structure. For more details and hints on workarounds, see the “Why does `UseLATEX.cmake` have to copy my tex files?” frequently asked question in Section 6.5.

### 3.1 Using a Bibliography

For any technical document, you will probably want to maintain a `BIBTEX` database of papers you are referencing in the paper. You can incorporate your `.bib` files by adding them after the `BIBFILES` argument to the `ADD_LATEX_DOCUMENT` command.

```
ADD_LATEX_DOCUMENT(MyDoc.tex BIBFILES MyDoc.bib)
```

This will automatically add targets to build your bib file and link it into your document. To use the `BIBTEX` file in your `LATEX` file, just do as you normally would with `\cite` commands and bibliography commands:

```
\bibliographystyle{plain}
\bibliography{MyDoc}
```

You can list as many bibliography files as you like.

### 3.2 Incorporating Images

To be honest, incorporating images into `LATEX` documents can be a real pain. This is mostly because the format of the images needs to depend on the version of `LATEX` you are running (`latex` vs. `pdflatex`). With these CMake macros, you only need to convert your raster graphics to `png` or `jpeg` format and your vector graphics to `eps` or `pdf` format. Place them all in a common directory (e.g. `images`) and then use the `IMAGE_DIRS` option to the `ADD_LATEX_DOCUMENT` macro to point to them. `UseLATEX.cmake` will take care of the rest.

```
ADD_LATEX_DOCUMENT(MyDoc.tex
  BIBFILES MyDoc.bib
  IMAGE_DIRS images
)
```

If you want to break up your image files in several different directories, you can do that, too. Simply provide multiple directories after the `IMAGE_DIRS` command.

```
ADD_LATEX_DOCUMENT(MyDoc.tex
  BIBFILES MyDoc.bib
  IMAGE_DIRS icons figures
)
```

Alternatively, you could list all of your image files separately with the `IMAGES` option.

```
SET(MyDocImages
  logo.eps
  icons/next.png
  icons/previous.png
  figures/flowchart.eps
  figures/team.jpeg
)
```

```
ADD_LATEX_DOCUMENT(MyDoc.tex
  IMAGES ${MyDocImages}
)
```

Both the `IMAGE_DIRS` and `IMAGES` can be used together. The combined set of image files will be processed. If you wish to provide a separate eps file and pdf or png file, that is OK, too. `UseLATEX.cmake` will handle that by copying over the correct file instead of converting.

Once you establish the images directory, `CMake` will automatically find all files with known image extensions (currently eps, pdf, png, jpeg, and jpg) in it and add makefile targets to use ImageMagick's `convert` to convert the file times to those appropriate for the build. (One exception is that `ps2pdf` will be used when converting eps to pdf to get around a problem where ImageMagick drops the bounding box information.) If you do not have ImageMagick, you can get it for free from <http://www.imagemagick.org>. `CMake` will also give you a `LATEX_SMALL_IMAGES` option that, when on, will downsample raster images. This can help speed up building and viewing documents. It will also make the output image sizes smaller.

`UseLATEX.cmake` will occasionally use a conversion program other than ImageMagick's `convert`. For example, `ps2pdf` will be used when converting eps to pdf to get around a problem where ImageMagick drops the bounding box information. When available, the `pdftops` from the Poppler utilities will be used to convert pdf to eps because it better preserves vector graphics and color spaces. At any rate, you do not need to worry about setting the appropriate image conversion program. `UseLATEX.cmake` will automatically select the best one and issue errors or warnings if there is a problem.

Depending on what program is launched to build your  $\LaTeX$  file (either `latex` or `pdflatex`, and `UseLATEX.cmake` supports both), a particular format for your image is required. As stated, `UseLATEX.cmake` handles the necessary conversions for you. However, you will not know in advance what file extension is used on the image. That is no problem. Simply leave out the file extension in the file name argument to `\includegraphics` and  $\LaTeX$  will find the file with the appropriate extension for you.

Note that in order to ensure that the resulting image files are placed in the appropriate directory, you are required to give *relative* paths for images and image directories. For example, `IMAGE_DIRS ${CMAKE_CURRENT_SOURCE_DIR}/images` will fail. Use `IMAGE_DIRS images` instead.

### 3.3 Create a PDF or PS by Default

By default, when you use `ADD_LATEX_DOCUMENT` and then run `make` with no arguments, the dvi file will be created. You have to specifically build the pdf target to use `pdflatex` to create a pdf file. However, oftentimes we want the pdf to be generated by default. To do that, simply use the `DEFAULT_PDF` option to `ADD_LATEX_DOCUMENT`:

```
ADD_LATEX_DOCUMENT(MyDoc.tex
  BIBFILES MyDoc.bib
  IMAGE_DIRS images
  DEFAULT_PDF
)
```

If you still want to use the `latex` program to compile your documents but by default want to create pdf files (that is, build the `safepdf` target by default), then use the `DEFAULT_SAFEPDF` option to `ADD_LATEX_DOCUMENT`:

```
ADD_LATEX_DOCUMENT(MyDoc.tex
  BIBFILES MyDoc.bib
  IMAGE_DIRS images
  DEFAULT_SAFEPDF
)
```

It is also possible to make postscript files by default by using the `DEFAULT_PS` option.

```
ADD_LATEX_DOCUMENT(MyDoc.tex
  BIBFILES MyDoc.bib
  IMAGE_DIRS images
  DEFAULT_PS
)
```

### 3.4 Create Nothing by Default

Sometimes it is desirable to disable the building of your  $\text{\LaTeX}$  document by default (that is, not build it with the `all` target). This is convenient when including  $\text{\LaTeX}$  documentation with some other source to build such as when you are documenting a library. To remove all targets from the default, simply add the `NO_DEFAULT` option to `ADD_LATEX_DOCUMENT`.

```
ADD_LATEX_DOCUMENT(MyDoc.tex
  BIBFILES MyDoc.bib
  IMAGE_DIRS images
  NO_DEFAULT
)
```

It is undefined what happens if you combine the `NO_DEFAULT` option with any of the other default build target options like `DEFAULT_PDF`.

### 3.5 SyncTeX-Enabled Editors

Some implementations of  $\text{\LaTeX}$  compilers have a feature called SyncTeX that allows an editor or viewer to link between the compiled version of the document (such as a pdf) and the original  $\text{\LaTeX}$  source code. The most common way to do this is to add `-synctex=1` to the `pdflatex` command. This will create a file named `\langle base-name \rangle.synctex.gz` where each part of the final document points to the original  $\text{\LaTeX}$  files.

However, there is a problem. `UseLATEX.cmake` copies all of the input  $\text{\LaTeX}$  source files to an out-of-source build directory (see Section 6.5 for more information on why). But the  $\text{\LaTeX}$  compiler does not know that. Thus, the created `\langle base-name \rangle.synctex.gz` will point to the temporary files in the build directory rather than your original source files.

`UseLATEX.cmake` can add commands to the make targets that “correct” the `\langle base-name \rangle.synctex.gz`. To add these commands, simply turn on the `LATEX_USE_SYNCTEX` in `ccmake` or equivalent CMake configuring tool. When this option is on, the `-synctex=1` argument is added to the  $\text{\LaTeX}$  compile commands (settable with the `LATEX_SYNCTEX_FLAGS` variable) and a command is added to targets that will find files in `\langle base-name \rangle.synctex.gz` and change their paths to the original files in the source directory.

## 4 Package Support

Modern  $\text{\LaTeX}$  distributions provide a great many packages to provide additional features to the document building process. A great many more packages are available in online package distributions. The vast majority of these packages provide features that are self contained within the  $\text{\LaTeX}$  call itself. That is, the build process does not have to change to accommodate these packages.

That said, there are a small number of packages that require supplementary programs to be run or to otherwise change the build process. These packages require special options to `ADD_LATEX_DOCUMENT`, which are documented here.

### 4.1 Making an Index

You can make an index in a  $\text{\LaTeX}$  document by using the `makeidx` package. However, this package requires you to run the `makeindex` command. Simply add the `USE_INDEX` option anywhere in the `ADD_LATEX_DOCUMENT` arguments, and `makeindex` will automatically be added to the build.

```
ADD_LATEX_DOCUMENT(MyDoc.tex
  BIBFILES MyDoc.bib
  IMAGE_DIRS images
  USE_INDEX
)
```

## 4.2 Making a Glossary

There are multiple ways to make a glossary in a L<sup>A</sup>T<sub>E</sub>X document, but the `glossaries` package provides one of the most convenient ways of doing so. Like the `makeidx` package, `glossaries` requires running `makeindex` or `xindy` for building auxiliary files. However, building the glossary files can be more complicated as there can be different sets of glossary files with different extensions. `UseLATEX.cmake` will handle that for you. It does it in a way similar to the `makeglossary` command, but in a more portable way. Simply add the `USE_GLOSSARY` option anywhere in the `ADD_LATEX_DOCUMENT` arguments, and the glossary creating will be handled for you.

```
ADD_LATEX_DOCUMENT(MyDoc.tex
  BIBFILES MyDoc.bib
  IMAGE_DIRS images
  USE_GLOSSARY
)
```

## 4.3 Nomenclature Support

The `nomencl` package provides a mechanism to collect nomenclature and print it together in a single section. The `nomencl` behaves very similarly to `glossaries` (described in Section 4.2) including running the `makeindex` command. However, the arguments to `makeindex` are a bit different (to avoid clashes with creating glossaries), and unfortunately `nomencl` provides no hints in the auxiliary file about it. Thus, `UseLATEX.cmake` provides a special `USE_NOMENCL` option to `ADD_LATEX_DOCUMENT` to add the necessary commands to build the nomenclature.

```
ADD_LATEX_DOCUMENT(MyDoc.tex
  BIBFILES MyDoc.bib
  IMAGE_DIRS images
  USE_NOMENCL
)
```

It should be noted that this feature only works with `nomencl` version 4.0 or later. The `nomencl` package changed how `makeindex` is called to make it compatible with indices and glossaries. The correct version of `nomencl` is easily identified as the one that uses the `\makenomenclature` and `\printnomenclature` commands (as opposed to the old `\makeglossary` and `\printglossary` commands). If you are using an older version of `nomencl`, you are best off to update for a number of reasons.

## 4.4 multibib Support

The `multibib` package provides a mechanism to create a set of distinct bibliographies that are not necessarily associated with sections of the document. Part



of the operation of this package creates multiple  $\text{\LaTeX}$  auxiliary files that need to be processed independently with  $\text{\BIBTeX}$ . Consequently, the build needs to be modified to run  $\text{\BIBTeX}$  multiple times with different inputs. This can be achieved with the `MULTIBIB_NEWCITES` argument to `ADD_LATEX_DOCUMENT`.

As an example, consider the following usage of the `multibib` package, partially taken from its documentation. It creates a set of distinct citation commands named `own`, `submitted`, and `internal` with the section heads `Own Work`, `Submitted Work`, and `Master Theses and Ph.D. Theses` respectively. They collectively use the bibliography files `own.bib`, `submitted.bib`, `techreports.bib`, and `theses.bib`.

```
\newcites{own,submitted,internal}%  
  {Own Work,%  
   Submitted Work,%  
   {Technical Reports, Master Theses and Ph.D. Theses}}
```

```
\bibliographyown{own.bib}
```

```
\bibliographysubmitted{submitted.bib}
```

```
\bibliographyinternal{techreports.bib,theses.bib}
```

The three suffixes specified to the `\newcite` command and the four bibliography files referenced must all be specified in the `ADD_LATEX_DOCUMENT` command with the `MULTIBIB_NEWCITES` and `BIBFILES` arguments, respectively.

```
ADD_LATEX_DOCUMENT(MyDoc.tex  
  BIBFILES own.bib submitted.bib techreports.bib theses.bib  
  MULTIBIB_NEWCITES own submitted internal  
)
```

## 5 Advanced Configurations

This document has heretofore described using `UseLATEX.cmake` for a single  $\text{\LaTeX}$  document and associated files (bibliographies, images, indices, etc.). However there are many configurations to document building that extend beyond this simple scenario including multipart files, multiple documents, and depended builds.

## 5.1 Multipart L<sup>A</sup>T<sub>E</sub>X Files

Often, it is convenient to split a L<sup>A</sup>T<sub>E</sub>X document into multiple files and use the L<sup>A</sup>T<sub>E</sub>X `\input` or `\include` command to put them back together. To do this, all the files have to be located together. UseLATEX.cmake can take care of that, too. Simply add the `INPUTS` argument to `ADD_LATEX_DOCUMENT` to copy these files along with the target tex file. Build dependencies to these files is also established.

```
ADD_LATEX_DOCUMENT(MyDoc.tex
  INPUTS Chapter1.tex Chapter2.tex Chapter3.tex Chapter4.tex
  BIBFILES MyDoc.bib
  IMAGE_DIRS images
  USE_INDEX
)
```

As far as UseLATEX.cmake is concerned, input files do not necessarily have to be tex files. For example, you might be including the contents of a text file into your document with the `\VerbatimInput` command of the `fancyvrb` package. In fact, you could also add graphic files as inputs, but you would not get the extra conversion features described in Section 3.2.

## 5.2 Configuring L<sup>A</sup>T<sub>E</sub>X Files

Sometimes it is convenient to control the build options of your tex file with CMake variables. You can achieve this by using the `CONFIGURE` argument to `ADD_LATEX_DOCUMENT`.

```
ADD_LATEX_DOCUMENT(MyDoc.tex
  INPUTS Chapter1.tex Chapter2.tex Chapter3.tex Chapter4.tex
  CONFIGURE MyDoc.tex
  BIBFILES MyDoc.bib
  IMAGE_DIRS images
  USE_INDEX
)
```

In the above example, in addition to copying `MyDoc.tex` to the binary directory, UseLATEX.cmake will configure `MyDoc.tex`. That is, it will find all occurrences of `@VARIABLE@` and replace that string with the current CMake variable `VARIABLE`.

With the `CONFIGURE` argument you can list the target tex file (as shown above) as well as any other tex file listed in the `INPUTS` argument.

```
ADD_LATEX_DOCUMENT(MyDoc.tex
  INPUTS Ch1Config.tex Ch1.tex Ch2Config.tex
```

```
Ch2.tex Ch3Config Ch3.tex
CONFIGURE Ch1Config.tex Ch2Config.tex Ch3Config.tex
BIBFILES MyDoc.bib
IMAGE_DIRS images
USE_INDEX
)
```

Be careful when using the `CONFIGURE` option. Unfortunately, the `@` symbol is used by `LATEX` in some places. For example, when establishing a tabular environment, an `@` is used to define the space between columns. If you use it more than once, then `UseLATEX.cmake` will erroneously replace part of the definition of your columns for a macro (which is probably an empty string). This can be particularly troublesome to debug as `LATEX` will give an error in a place that, in the original document, is legal. Hence, it is best to only configure `tex` files that contain very little text of the actual document and instead are mostly setup and options.

### 5.3 Building Multiple `LATEX` Documents

The most common use for `UseLATEX.cmake` is to build a single document, such as a paper you are working on. However, some use cases involve building several documents at one time. To do this, you must call `ADD_LATEX_DOCUMENT` multiple times. However, if you do this, the `dvi`, `pdf`, etc. targets will be generated multiple times, and that is illegal in `CMake`. To get around this, you need to mangle the names of the targets that `ADD_LATEX_DOCUMENT` creates. To do this, use the `MANGLE_TARGET_NAMES` option.

```
ADD_LATEX_DOCUMENT(MyDoc1.tex MANGLE_TARGET_NAMES)
ADD_LATEX_DOCUMENT(MyDoc2.tex MANGLE_TARGET_NAMES)
```

In the example above, the first call to `ADD_LATEX_DOCUMENT` will create targets named `MyDoc1.dvi`, `MyDoc1.pdf`, `MyDoc1.ps`, etc. whereas the second call will create targets named `MyDoc2_*`.

If you still want the simple, short targets to build all of the documents, you can add them yourself with custom targets that depend on the targets created by `ADD_LATEX_DOCUMENT`

```
ADD_CUSTOM_TARGET(dvi)
ADD_DEPENDENCIES(MyDoc1_dvi MyDoc2_dvi)
ADD_CUSTOM_TARGET(pdf)
ADD_DEPENDENCIES(MyDoc1_pdf MyDoc2_pdf)
ADD_CUSTOM_TARGET(ps)
ADD_DEPENDENCIES(MyDoc1_ps MyDoc2_ps)
```

## 5.4 Identifying Dependent Files

In some circumstances, CMake’s configure mechanism is not sufficient for creating input files. Input  $\LaTeX$  files might be auto-generated by any number of other mechanisms.

If this is the case, simply add the appropriate CMake commands to generate the input files, and then add that file to the `DEPENDS` option of `ADD_LATEX_DOCUMENT`. To help you build the CMake commands to place the generated files in the correct place, you can use the `LATEX_GET_OUTPUT_PATH` convenience function to get the output path.

```
LATEX_GET_OUTPUT_PATH(output_dir)

ADD_CUSTOM_COMMAND(OUTPUT ${output_dir}/generated_file.tex
  COMMAND tex_file_generate_exe
  ARGS ${output_dir}/generated_file.tex
  )

ADD_LATEX_DOCUMENT(MyDoc.tex DEPENDS generated_file.tex)
```

## 6 Frequently Asked Questions

This section includes resolutions to common questions and issues concerning use of `UseLATEX.cmake` and with  $\LaTeX$  in general.

### 6.1 How do I process $\LaTeX$ files on Windows?

I have successfully used two different ports of LaTeX for windows: the cygwin port (<http://www.cygwin.com/>) and the MikTeX port (<http://www.miktex.org/>).

If you use the cygwin port of  $\LaTeX$ , you must also use the cygwin port of CMake, make, and ImageMagick. If you use the MikTeX port of  $\LaTeX$ , you must use the CMake from <http://www.cmake.org/HTML/Download.html>, the ImageMagick port from <http://www.imagemagick.org/script/index.php>, and a native build tool like MSVC or the GNU make port at <http://unxutils.sourceforge.net/>. *Do not use the “native” CMake program with any cygwin programs or the cygwin CMake program with any non-cygwin programs.* This issue at hand is that the cygwin ports create and treat filenames differently than other windows programs.<sup>1</sup>

Also be aware that if you have images in your document, there are numerous problems that can occur on Windows with the ImageMagick `convert` program. See Section 6.7 for more information.

---

<sup>1</sup>If you are careful, you can use the cygwin version of make with the windows ports of CMake,  $\LaTeX$ , and ImageMagick. It is an easy way around the problems described in Section 6.7.

## 6.2 How do I process $\LaTeX$ files on Mac OS X?

Using  $\LaTeX$  on Mac OS X is fairly straightforward because this OS is built on top of Unix. By using the Terminal program or X11 host, you can run  $\LaTeX$  much like any other Unix variant. The only real issue is that  $\LaTeX$  and some of the supporting programs like CMake and ImageMagick are not typically installed (whereas on Linux they often are).

Most applications port fairly easily to Mac OS so long as you are willing to use them as typical Unix or X11 programs. To make things even easier, I recommend taking advantage of a Mac porting project to make this process even easier. MacPorts (<http://www.macports.org>) is a good tool providing a comprehensive set of tool ports including  $\LaTeX$ , CMake, and ImageMagick. The fink project and FinkCommander (<http://finkcommander.sourceforge.net/>) is a similar although less active project.

## 6.3 How do I process with $X_{\LaTeX}$ ?

UseLATEX.cmake was not designed with  $X_{\LaTeX}$  in mind, but the interface of that program is similar enough to  $\LaTeX$  that you should be able to use it. Simply change the `PDFLATEX_COMPILER` CMake variable to the `xelatex` program and build the pdf target.

## 6.4 How do I process with Lua $\LaTeX$ ?

UseLATEX.cmake was not designed with Lua $\LaTeX$  in mind, but the interface of that program is similar enough to  $\LaTeX$  that you should be able to use it. Simply change the `PDFLATEX_COMPILER` CMake variable to the `lualatex` program and build the pdf target.

## 6.5 Why does UseLATEX.cmake have to copy my tex files?

UseLATEX.cmake cannot process your tex file without copying it. As explained in Section 3,  $\LaTeX$  is very picky about file locations. The relative locations of files that your input files point to, and all but the most simple  $\LaTeX$  files point to other files, must remain consistent.

UseLATEX.cmake will often have to modify at least one file either through configurations or image format and size conversions. When creating new files, UseLATEX.cmake will have to copy either all of the files or none of the files. Since configuring and writing over an original file is unacceptable, UseLATEX.cmake forces you to configure it such that  $\LaTeX$  builds in a different directory than where you have placed the original. If you do not specify a separate directory, you get an error like the following.

```
CMake Error at UseLATEX.cmake:377 (MESSAGE):
  LaTeX files must be built out of source or you must set
  LATEX_OUTPUT_PATH.
```

The best way around this problem is to do an “out of source” build, which is really the preferred method of using CMake in general. To do an out of source build, create a new build directory, go to that directory, and run `cmake` from there, pointing to the source directory.

If for some reason an out of source build is not feasible or desirable, you can set the `LATEX_OUTPUT_PATH` variable to a directory other than `.` (the local directory). If you are building a  $\LaTeX$  document in the context of a larger project for which you wish to support in source builds, consider pragmatically setting the `LATEX_OUTPUT_PATH` CMake cache variable from within your `CMakeLists.txt`.

## 6.6 How can $\LaTeX$ find a file not a tex, image, or bibliography?

The most common files included from a  $\LaTeX$  tex file are other tex files, images, and bibliographies, all of which are handled with options to `ADD_LATEX_DOCUMENT`.

But what happens if the  $\LaTeX$  build includes some other type of file? For example, the `fancyvrb` package can import a text file with the `\VerbatimInput` command to be formatted in a teletype font. Other examples occur, such as program formatting packages that can read in source code files.

As far as `UseLATEX.cmake` is concerned, these types of files are simply other inputs to  $\LaTeX$  and handled in the same way as included tex files. They can be included by adding them to the `INPUTS` argument as described in Section 5.1.

If an inputted file does not immediately exist but is generated by some other process, then the file should be generated in the output directory and added to the `DEPENDS` of the build as described in Section 5.4.

## 6.7 Why is `convert` failing on Windows?

Assuming that you have correctly downloaded and installed an appropriate version of ImageMagick (as specified in Section 6.1), there are several other problems that users can run into the created build files attempt to run the `convert` program.

A common error is that `convert` not finding a file that is clearly there.

```
convert: unable to open image 'filename'
```

If you notice that the drive letter is stripped off of the filename (i.e. `C:`), then you are probably mixing the Cygwin version of `convert` with the non-cygwin CMake. The cygwin version of `convert` uses the colon (`:`), as a directory separator for inputs. Thus, it assumes the output file name is really two input files separated by the colon. Switch to the non-cygwin port of ImageMagick to fix this.

If you are using `nmake`, you may also see the following error:

```
convert.exe: unable to open image 'C:': Permission denied.
```

I don't know what causes this error, but it appears to have something to do with some strange behavior of `nmake` when quoting the `convert` executable. The easiest solution is to use a different build program (such as `make` or `MSVC's IDE` or a unix port of `make`). If anyone finds away around this problem, please contribute back.

Another possible error seen is

```
Invalid Parameter - filename
```

This is probably because `CMake` has found the wrong `convert` program. Windows is installed with a program named `convert` in `%SYSTEMROOT%\system32`. This `convert` program is used to change the filesystem type on a hard drive. Since the windows `convert` is in a system binary directory, it is usually found in the path before the installed `ImageMagick convert` program. (Don't get me started about the logic behind this.) Make sure that the `IMAGEMAGICK_CONVERT` `CMake` variable is pointing to the correct `convert` program. Recent versions of `UseLATEX.cmake` should give a specific warning about this with instructions on how to fix it.

## 6.8 How do I automate plot generation with command line programs?

`LATEX` is often used in conjunction with plotting programs that run on the command line like `gri` or `gnuplot`. Although there is no direct support for these programs in `UseLATEX.cmake`, it is straightforward to use these programs.

One way to use a plotting program is simply to run it yourself to generate the plot and then incorporate the image file into your `LATEX` document as you would any other image file (see Section 3.2). This the easiest way to incorporate these plots since it does not require additional `CMake` code. It also ensures consistency of how the plot looks (often the plots will look different if created on different platforms), and it provides the opportunity to edit the image to make it look better for publication.

Another way to use these plotting programs is to automatically run them when building the `LATEX` document. This is convenient if you frequently change the data you are plotting or if you are creating many plots. To automate running the plotting program build one or more targets to generate these files and then add these targets as `LATEX` dependencies (see Section 5.4 for information on adding dependencies). Here is an example of creating the targets for converting a directory of `gri` files and incorporating the resulting files in a `LATEX` document.

```
# Set GRI executable
SET(GRI_COMPILE "/usr/bin/gri")
```

```

# Set the location of data files
SET(DATA_DIR data)
# Set the location of the directory for image files
SET(IMAGE_DIR graphics)

# Get a list of gri files
FILE(GLOB_RECURSE GRI_FILES "*.gri")

FOREACH(file ${GRI_FILES})
  GET_FILENAME_COMPONENT(basename "${file}" NAME_WE)
  # Replace stings in gri file so data files can be found
  FILE(READ
    ${CMAKE_CURRENT_SOURCE_DIR}/${IMAGE_DIR}/${basename}.gri
    file_contents
  )
  STRING(REPLACE "${DATA_DIR}" "${IMAGE_DIR}/${DATA_DIR}"
    changed_file_contents ${file_contents}
  )
  FILE(WRITE
    ${CMAKE_CURRENT_BINARY_DIR}/${IMAGE_DIR}/${basename}.gri
    ${changed_file_contents}
  )

  # Command to run gri
  IF(GRI_COMPILE)
    ADD_CUSTOM_COMMAND(
      OUTPUT
        ${CMAKE_CURRENT_BINARY_DIR}/${IMAGE_DIR}/${basename}.eps
      DEPENDS
        ${CMAKE_CURRENT_BINARY_DIR}/${IMAGE_DIR}/${basename}.gri
        ${CMAKE_CURRENT_BINARY_DIR}/${IMAGE_DIR}/${DATA_DIR}
      COMMAND
        ${GRI_COMPILE}
      ARGS
        -output
        ${CMAKE_CURRENT_BINARY_DIR}/${IMAGE_DIR}/${basename}.eps
        ${CMAKE_CURRENT_BINARY_DIR}/${IMAGE_DIR}/${basename}.gri
    )
  ENDIF(GRI_COMPILE)
  # Make a list of all gri files (for ADD_LATEX_DOCUMENT depend)
  SET(ALL_GRI_FILES ${ALL_GRI_FILES}
    ${CMAKE_CURRENT_BINARY_DIR}/${IMAGE_DIR}/${basename}.eps
  )
ENDFOREACH(file)

# Copy over all data files needed to generate gri graphs

```



```

ADD_CUSTOM_COMMAND(
  OUTPUT  ${CMAKE_CURRENT_BINARY_DIR}/${IMAGE_DIR}/${DATA_DIR}
  DEPENDS ${CMAKE_CURRENT_SOURCE_DIR}/${IMAGE_DIR}/${DATA_DIR}
  COMMAND ${CMAKE_COMMAND} -E copy_directory
          ${CMAKE_CURRENT_SOURCE_DIR}/${IMAGE_DIR}/${DATA_DIR}
          ${CMAKE_CURRENT_BINARY_DIR}/${IMAGE_DIR}/${DATA_DIR}
)

ADD_LATEX_DOCUMENT(MyDoc.tex
  IMAGE_DIRS ${IMAGE_DIR}
  DEPENDS ${ALL_GRI_FILES}
)

```

## 6.9 Why does make stop after each image conversion?

There is a bug in the ImageMagick convert version 6.1.8 that inappropriately returns a failure condition even when the image convert was successful. The problem might also occur in other ImageMagick versions. Try updating your installation of ImageMagick.

## 6.10 How do I resolve `\write 18` errors with `psricks` or `pdftricks`?

A `\write18` command is  $\text{\LaTeX}$ 's obtuse syntax for running a command on your system. Commands in the `psricks` and `pdftricks` packages may need to run commands on your system to, for example, convert graphics from one format to another.

Unfortunately, allowing  $\text{\LaTeX}$  to run commands on your system can be considered a security issue. Some versions of  $\text{\LaTeX}$  such as  $\text{\MikTeX}$  disable the feature by default. Thus, in order to use packages that rely on `\write18`, you may have to enable the feature, typically with a command line option. For  $\text{\MikTeX}$ , this command line option is `--enable-write18`.

You can instruct `UseLATEX.cmake` to pass any flag to  $\text{\LaTeX}$  by adding it to the `LATEX_COMPILER_FLAGS` CMake variable. One way to do this is through the CMake GUI. Simply go to the advanced variables, find `LATEX_COMPILER_FLAGS`, and add `--enable-write18` (or equivalent flag) to the list of arguments.

You can also automatically add this flag by setting the flag in your `CMakeLists.txt` file. For example:

```

SET(LATEX_COMPILER_FLAGS
  "-interaction=nonstopmode --enable-write18"
  CACHE STRING "Flags passed to latex."
)
INCLUDE(UseLATEX.cmake)

```

The disadvantage of this latter approach is the reduction of portability. This addition could cause a failure for any L<sup>A</sup>T<sub>E</sub>X implementation that does not support the `--enable-write18` flag (for which there are many).

### 6.11 Why is UseL<sup>A</sup>T<sub>E</sub>X.cmake complaining about image file names?

If you have an image file with a filename that contains multiple periods, for example `my.image.pdf`, UseL<sup>A</sup>T<sub>E</sub>X.cmake will issue a warning like the following.

```
Some LaTeX distributions have problems with image file names
with multiple extensions. Consider changing my.image.pdf to
something like my-image.pdf.
```

This is because, just as the warning reports, some versions of L<sup>A</sup>T<sub>E</sub>X have problems with including image filenames with multiple extensions. For example, if you tried to include `my.image.pdf` with a command like

```
\includegraphics{my.image}
```

then some versions of L<sup>A</sup>T<sub>E</sub>X will respond that the image extension `.image` is not recognized or that the file `my.image` is not found because it fails to look for files with valid extensions.

Although it is inadvisable (per Section 3.2), you might try to get around the problem by specifying the extension like this.

```
\includegraphics{my.image.pdf}
```

This might work, or it might just make L<sup>A</sup>T<sub>E</sub>X complain that it does not recognize images with extension `.image.pdf`.

In the end, the best solution is to simply use filenames that will not trouble L<sup>A</sup>T<sub>E</sub>X. Even though some L<sup>A</sup>T<sub>E</sub>X distributions (like MacT<sub>E</sub>X) seem to handle this extension ambiguity correctly, others clearly do not. Thus, even if your L<sup>A</sup>T<sub>E</sub>X distribution handles these image filenames correctly, it is still a bad idea in case you need to change distributions or build on other computers. Your best course of action is to simply heed the warning and rename your files.

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## A Sample CMakeLists.txt

Following is a sample listing of `CMakeLists.txt`. In fact, it is the `CMakeLists.txt` that is used to build this document.

```
CMAKE_MINIMUM_REQUIRED(VERSION 2.6)

PROJECT(UseLATEX_DOC NONE)

INCLUDE(UseLATEX.cmake)
```

```
# Note that normally CMakeLists.txt would not be considered an
# input to the document, but in this special case of documenting
# UseLATEX.cmake the contents of this file is actually included
# in the document.
ADD_LATEX_DOCUMENT(UseLATEX.tex
  INPUTS CMakeLists.txt
)
```