Installing channelflow under Mac OSX

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This documentation is a quick walk-through the installation process of *channelflow* (revision 447) on a Mac OS X system. We were able to install it under OS 10.11 "*El Capitan*" and OS 10.7 "*Lion*". An attempt to install it under OS 10.5 "*Leopard*" was not successful due to limitations in the available *g++* compiler and the user rights.

Requirements

The *Xcode Command Line Tools* has to be installed on the target system. Under *El Capitan* we installed *Xcode* via the *AppStore* and installed the tools via *Terminal* command

```
  xcode-select --install
```

Additionally we need a *fortran* compiler to install *eigen.* Pre-compiled binaries and an extensive guide are available online[1].

Install Dependencies: HDF5 Channelflow saves the flow field data in the hdf5 format on the hard disk. The latest *hdf5* version can be downloaded from the project website[2] and can be extracted into the preferred location

```
  tar xvf <hdf5file.tar.gz> -C <path to extract to>
```

We create a new *build* directory

```
  mkdir <path to extracted files>/../build
```

and run within this new directory the *configure* script

```
  <path to extracted files>/configure --prefix=<install path> --enable-cxx --enable-shared
--disable-static CXX="clang++
```

Next we can build and install the binaries with the commands

```
  make -j
  make check
  make install
  make check-install
```

Hint: The second command may takes up to one hour.

Install Dependencies: fftw3

The *fftw3* library contains routines to calculate the Discrete Fourier Transformation and is a key component of *channelflow.* A possible multi-core implementation can improve the *channelflow* performance even further.

After a successfull download[3], the installation process follows the same scheme:

Extract the files in the directory

```
  tar xvf <fftw-3.tar.gz> -C <path to extract to>
```

Create a new *build* directory

```
  mkdir <path to extracted files>/../build
```

Configure the *make* script

```
  <path to extracted files>/configure --prefix=<install path> --enable-shared --disable-static
```

[1] https://wiki.helsinki.fi/display/HUGG/GNU+compiler+install+on+Mac+OS+X

[2] http://www.hdfgroup.org/

[3] http://www.fftw.org/

and run the *make* script

```
make -j && make check && make install
```

Install Dependencies: cmake

The *Eigen3* library as well as *channelflow* itself use *cmake* to create and configure the *make* script. *cmake* can be downloaded from the official website[4]. The installation process is started by extracting the source files and creating the *build* directory

```
tar xvf <cmake.tar.gz> -C <path to extract to>
mkdir <path to extracted files>/../build
```

The configuration of *cmake* is slightly different

```
<path to extracted files>/bootstrap --prefix=<install path>
```

The remaining steps are exactly the same

```
make -j && make check && make install
```

Install Dependencies: Eigen3

Eigen3 is a linear algebra library. It can be downloaded from the website[5]. We extract the source files and create a new directory.

```
tar xvf <eigen.tar.bz2> -C <path to extract to>
mkdir <path to extracted files>/../build
```

For the first time we use *cmake*. To access the binaries easily we modified the *PATH* environment variable. We can automate this by adding the line

```
export PATH=<install path>/bin:$PATH
```

to the file `$HOME/.bash_profile`. Afterwards we need to restart the *Terminal* so that the changes can take effect.

We use *cmake* to install *Eigen3*

```
cmake <path to extracted files> -DCMAKE_INSTALL_PREFIX=<install path>
```

Next we run the checks and install the binaries

```
make check
make install
```

Hint: Sometimes the first command produces an error message. Nevertheless the installation can be completed and *channelflow* will work as desired.

Prepare channelflow for installation

The last step is to install the simulation library itself. We obtained *channelflow* directly from the subversion repository. If no subversion client is available, a numbered release can be downloaded from the website[6]. Within the desired `<channelflow path>` we run the command

```
svn co http://svn.channelflow.org/channelflow
```

We have to modify the source code before we can proceed with the compiling. In the file `<channelflow path/trunk/channelflow/mathdefs.h>` we have to replace the line

```
//typedef unsigned int uint;
```

by

```
typedef unsigned int uint;
```

In the file `<channelflow path>/trunk/CMakeList.txt` we have to replace line 130 and 136

[4] https://cmake.org/

[5] http://eigen.tuxfamily.org/

[6] http://channelflow.org/dokuwiki/doku.php?id=download

from

```
  if(HAVE_<libname>
```

to

```
  if(False)
```

and change the hard coded *hdf5* library name in line 116 from

```
  set(LIBS $LIBS $HDF5_LIBDIR/libhdf5_cpp.so)
```

to

```
  set(LIBS $LIBS $HDF5_LIBDIR/libhdf5_cpp.dylib)
```

Another change has to be done in `<channelflow path>/programs/projectseries.cpp`. We change the line

```
  FlowField e[Nbasis];
```

to

```
  FlowField *e = newFlowField[Nbasis];
```

and add after line 126 the statement

```
  delete [] e;
```

Install channelflow

After all those steps the installation can be done with the lines

```
  mkdir <channelflow path>/build
  cd <channelflow path>/build
  cmake -DCMAKE_INSTALL_PREFIX=<install path> ../trunk
  make
  make install
```

Before we can use the *channelflow* library programs and create our own extensions, we have to add the line

```
  export DYLD_LIBRARY_PATH=<install path>/lib:$DYLD_LIBRARY_PATH
```

to the file `$HOME/.bash_profile` and restart the *Terminal*.

Final hint

- We have not used the possibility of *hdf5* and *channelflow* to compress the calculated flow fields nor to make use of multicore CPUs. By modifying the compiling flags, providing the necessary libraries and modifing the `CMakeList.txt` differently, we can probably decrease the used storage disk space and improve the overall performance.

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