sumMIT\textsuperscript{1}

Educational software for the teaching of Computational Mechanics of Materials
Massachusetts Institute of Technology

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Chapter 1

Introduction

Under construction
Chapter 2

Installation

2.1 Starting a bash shell

The bash shell is the shell supported and recommended by the 16.225 staff. First you will need to copy Athena-related shell initialization files that run when the shell starts:

```
athena$ cd /usr/prototype_user
athena$ cp .bashrc .bash_login ~
athena$ cd ~
```

These files need to be copied only once.

If you want to change your Athena login shell to bash permanently you need to issue the following command:

```
athena$ chsh bash
```

Otherwise, you can either run the bash shell temporarily by doing:

```
athena$ bash --login
```

2.2 Attaching the course locker

sumMIT is available on the 16.225 Computational Mechanics of Materials Athena course locker. The first step to access sumMIT is to attach to the Athena locker:

```
athena$ attach 16.225
```
2.3 Shell environment configuration

The next step for using sumMIT is to configure your shell environment. If you have opted not to use the bash shell you will need to modify the syntax below to the appropriate syntax of your favorite shell.

A bash shell script for configuring sumMIT is provided in the sumMIT installation on Athena. This file may be accessed at /mit/16.225/sumMIT/config.sh. The file contents are:

```
add gnu

# build system
export SUMMIT_DIR=/mit/16.225/sumMIT
export BLD_CONFIG=$SUMMIT_DIR/config
export PATH=$BLD_CONFIG/make:$PATH
export BLD_ROOT=$SUMMIT_DIR/builds
export EXPORT_ROOT=$SUMMIT_DIR/products
export DEVELOPER=rapa
export LD_LIBRARY_PATH=$EXPORT_ROOT/lib:$LD_LIBRARY_PATH

# custom compiler settings for athena
unset TARGET_F77
export TARGET_COMPILER=gcc

# PYTHON settings
add python
export PYTHON_DIR=/mit/python
export PYTHON_VERSION=2.2
export PYTHON_LIBDIR=$PYTHON_DIR/lib/python$PYTHON_VERSION
export PYTHON_INCDIR=$PYTHON_DIR/include/python$PYTHON_VERSION
export PYTHONSTARTUP=$SUMMIT_DIR/.python
export PYTHONPATH=${EXPORT_ROOT}/modules:${EXPORT_ROOT}/scripts
```

In order to make these necessary variables available to your environment the following command needs to be executed from your shell:

```
6
```
2.4 Testing the installation

In order to test the installation:

- copy the whole examples directory into your own locker as follows:

  athena$ cd ~
  athena$ mkdir -p mySumMIT
  athena$ cd !$
  athena$ cp -r /mit/16.225/sumMIT/examples .

- Building and running the first example

  athena$ cd examples/summit-000
  athena$ mm

The last command creates the executable: summit.exe Try out the command:

  athena$ ./summit.exe

The output you should see is:

Neo-Hookean material extended to the compressible range:
  mass density ............ =  0.000000E+00
  Young’s modulus ....... =  7.000000E+10
  Poisson’s ratio ....... =  3.300000E-01
  1st Lame constant ........... =  5.108359E+10
  2nd Lame constant ... =  2.631579E+10
Applying load in step: 1
Applying load in step: 2
Applying load in step: 3
Applying load in step: 4
Applying load in step: 5
Applying load in step: 6
Applying load in step: 7
Applying load in step: 8
Applying load in step: 9
Applying load in step: 10

This solves Laplace’s equation on a square plate with Dirichlet boundary conditions on all edges, three of them at a value $T = 0$, one of them at a value specified by the user with the command line option -a.

```
athena$ ./summit.exe -a 10
```

Other command line options allow the specification of:

- `-h` mesh size (try values ranging from 1 to 0.01)
- `-s` number of loading steps (default 10)

- In addition to the log messages you see on your screen the program produces its output in the following `tecplot` files:

```
athena$ ls -ltr *.tec
-rw-r----- 1 rapa rapa 2455 Sep 9 14:11 temperature.tec
-rw-r----- 1 rapa rapa 2565 Sep 9 14:11 temperature.010.tec
-rw-r----- 1 rapa rapa 2584 Sep 9 14:11 temperature.009.tec
-rw-r----- 1 rapa rapa 2582 Sep 9 14:11 temperature.008.tec
-rw-r----- 1 rapa rapa 2581 Sep 9 14:11 temperature.007.tec
-rw-r----- 1 rapa rapa 2586 Sep 9 14:11 temperature.006.tec
-rw-r----- 1 rapa rapa 2587 Sep 9 14:11 temperature.005.tec
-rw-r----- 1 rapa rapa 2586 Sep 9 14:11 temperature.004.tec
-rw-r----- 1 rapa rapa 2590 Sep 9 14:11 temperature.003.tec
-rw-r----- 1 rapa rapa 2593 Sep 9 14:11 temperature.002.tec
-rw-r----- 1 rapa rapa 2599 Sep 9 14:11 temperature.001.tec
```

These output files may be visualized on your athena workstation using `tecplot` as follows:

```
athena$ add tecplot
athena$ tecplot temperature.0*.tec
```
The result should look like the figure.