**INSTALLATION GUIDE FOR BRODErs++**

* Download the boost library ([boost\_1\_80\_0.tar.gz](https://boostorg.jfrog.io/artifactory/main/release/1.80.0/source/boost_1_80_0.tar.gz)) from

<https://www.boost.org/users/history/version_1_80_0.html> and transfer the files to PUMA.

* Unzip the file on your home puma account.
* Run bootstrap.sh inside the folder.
* Afterward run b2 with the command “./b2”
* If you have installed the mutation library, you do not need to do anything.
* Download the [broderspp](https://github.com/broderspp) library by cloning: <https://github.com/broderspp/brODErspp.git>
* Inside the directory, you need to define “CMakeLists.txt” paths for the boost and mutation libraries.

set(BOOST\_DIRECTORY "/home/u19/otumuklu/boost/boost\_1\_80\_0" CACHE STRING "Boost library directory")

if(BOOST\_DIRECTORY)

set(BOOST\_ROOT ${BOOST\_DIRECTORY})

set(Boost\_NO\_SYSTEM\_PATHS ON)

find\_package( Boost REQUIRED )

include\_directories(${Boost\_INCLUDE\_DIRS})

endif()

As seen, the installed boost library locates at “/home/u19/otumuklu/boost/boost\_1\_80\_0”. Update this line based on your installed path.

* Similarly, find the location of the installed mutation library to update “CMakeLists.txt”

set(MPP\_INSTALL\_DIR "/home/u19/otumuklu/Mutationpp/install" CACHE PATH "Mutation++ installation directory")

include\_directories(${MPP\_INSTALL\_DIR}/include/mutation++)

#include\_directories(${MPP\_INSTALL\_DIR}/include/eigen3)

include\_directories(${MPP\_INSTALL\_DIR}/../thirdparty/eigen)

include\_directories(${MPP\_INSTALL\_DIR}/include/)

link\_directories(${MPP\_INSTALL\_DIR}/**lib64**)

Also make sure that your library paths are correct. It might be “lib” or “lib64”. Change the path accordingly.

* Allocate an interactive job on PUMA.
* Export the following flags:

export CC=$(which gcc)

export CXX=$(which g++)

module load cmake

Then follow the steps given in the manual. That is,

1. mkdir build
2. cd built
3. cmake .. *(Note that I did not use ccmake just cmake)*
4. make install

* After all, it should be installed fine. Check it out with a test case. The installed executable should be in your build file as “brODErs++” The following test case , named as “test.dat”, is created. You can run the case with

**“./brODErs++ test.dat”**

# --------------- Mixture options ---------------------

Problem type:

shocking

Name of the mixture:

air\_5

State model:

ChemNonEq1T

Thermodynamic database:

RRHO

# ---------------- Output parameters ------------------

Species output type: # the default value is mass\_fraction

mole\_fraction

Print sol each N steps: # this is optional. Default is 1

5

# --------------- Free-stream conditions-------------------

FS Press: # [Pa]

12.3

FS Temp: # [K]

100

FS Vel: # [m/s]

10000

# --------------- Mesh parameters ---------------------

Mesh X\_init: # [m]

0.0

Mesh X\_final: # [m]

5.0e-3

Mesh dX: # [m]

1.0e-8

**The outcome should be**

Input file was read:

Problem type: shocking

Mixture: air\_5

State model: ChemNonEq1T

Thermodynamic database: RRHO

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Free-stream conditions:

Press [Pa]: 12.3

Temp [K]: 100

Vel [m/s]: 10000

Computed mass flux [kg/m2 s]: 4.26797

Computed density [kg/m3]: 0.000426797

Mesh parameters:

X\_initial [m]: 0

X\_final [m]: 0.005

dX [m]: 1e-08

Output settings:

Species output type: mole\_fraction

Solution is printed each 5 steps.

Compute jump conditions...

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Pre-shock conditions (given)

P1 : 12.3 [Pa]

T1 : 100 [K]

US : 10000 [m/s]

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Post-shock conditions (cold gas approximation)

P2 : 35564.4 [Pa]

T2 : 48287.4 [K]

US-U2 : 1670.03 [m/s]

RHO2 : 0.00255563 [kg/m^3]

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Newton-Raphson converged in 5 iterations and the residual are 2.33201e-13

Post-shock conditions (hot gas approximation)

P2 : 38687.2 [Pa]

T2 : 29513.6 [K]

US-U2 : 938.339 [m/s]

Mach number 0.525416 [-]

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======> STARTING THE INTEGRATION <======

Position x [m] X\_N X\_O X\_NO X\_N2 X\_O2 U [m/s] T [K]

Sol: 5.77778567884427e-07 0.00164561765929604 0.00215177063314853 8.29476832234052e-06 0.787673075410725 0.208521241528509 938.354573644101 29457.9798656256

Sol: 5.52348788548767e-06 0.0168081786654163 0.0206183019639227 0.000621444685744121 0.76650172847597 0.195450346208947 938.674359314274 28970.5629451804

Sol: 1.03485294880748e-05 0.0336891277132494 0.0390145589635421 0.00165875136700979 0.743608104222681 0.182029457733518 939.355231663495 28468.3154763338

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