Energy Technology Center
Luleå University of Technology

CFD with OpenSource software, assignment 3.1

---

**Reviewer comments and suggestions on**

**"OpenFOAM Tutorial: Modeling Free Sureface Flow using multiphaseInterFoam"**
**Author: Annika Gram**

---

*Reviewer:*
Per Carlsson per.carlsson@etcpitea.se

February 11, 2009

# 1 General comments

The author has supplied a draft to a tutorial, which in the reviewer's mind, need further work. The report seems to be written quite hastily; some parts are missing, the authors notes are still included in the draft, some parts are even unprofessional. Put together, this does not give a solid impression at all. Based on the authors presentation in Gothenburg (which was good) the reviewer expected more from this report. To make the review (section 2) easy to follow it has the same structure and heading names as presented in the original report. Suggestions for improvement, remarks and questions are itemized in each individual section with an out take of the report starting each item for orientation.

# 2 Tutorial multiphaseInterFoam

## 2.1 Introduction

- Line 2: (see below)
  Use "can be found in section" or similar, the Herschel-Bulkley viscosity model can not be found on this page.
- Line 3: ..gamma, OpenFOAM uses bla bla
  Skip or write something useful.
- Line 5: The case can be extended...
  The case can probably be extended to include quantum theory if the user wants to, but what is shown in the tutorial and where?
- Line 7: The following is covered in the basic tutorial.
  What is covered in the advanced tutorial?
- Line 10: Defining the geometry of the phases using `setFields`
  Are the locations of the phases specified here also, or are they specified elsewhere?

## 2.2 Description of the case

- Line 1: The geometry for this case is based ...
  The geometry used in this tutorial is the same as in "Free surface tutorial using interFoam and rasInterFoam", by Hassan Hemida which can be found at

  `http://www.tfd.chalmers.se/~hani/kurser/OS_CFD_2007/`

  However, to keep computational time down the geometry was shortened 80mm as can bee seen in figure `##`
- No figure caption
- No width of bottle
- Line 4: The material model for the concrete..
  Remodel the modeled sentence.
  Is Herschel-Bulkley a viscosity model or a material model or are the two the same thing?
  A reference would be nice
- Line 5: Such a material is defined..
  Such a material has a viscosity defined as...
- Line 8: As the material ages..
  where $\tau_0$ is the ?, $\mu_{pl}$ is the ?
  Since this is your field of research how is $\tau_0$ and $\mu_{pl}$ described ? $\tau_0 = \tau_0(t, T, p)$ where t is time, T temperature and p pressure?

## 2.3 Preliminary task

- Section heading: Preliminary task
  What do you mean by preliminary?
- Line 1: Case files are provided where?
- Provide copy instructions
- Line 3: In this directory the following folders are to be seen:
  In the `splash` directory there are three directories; the `/0`, which contains the initial solution, the `constant`, which contains....and the...
- Expand this section

## 2.4 Mesh and Boundary Conditions

- Line 1: A fully-structured mesh of the geometry above..
  No figure above, A fully-structured mesh of the geometry showed in figure xx
- Line 2: There is no need to change anything..
  If no changes are needed why list the complete `blockMeshDict`-file?
  If this file is necessary in the report put it in Appendix
- After `blockMeshDict`: We see that the front and back walls of the bottle are adiabatic..
  Do you have any heat transfer at all in your case?
- What about the rest of the boundaries?

## 2.5 Case Definition

- Line 1: The definition of the case in this example
  Skip example

### 2.5.1 Initial and Boundary Conditions

- Section heading: Boundary conditions again?
- Line 1: The followings holds for this case:
  Holds what?
  In table xx the initial and boundary conditions are summarized
- No table caption
- Table makes no sense, missing headings
- *pd* has a initial condition set to `zeroGradient` and a something that does not show to `fixedValue` and `uniform 0 for atmosphere`
- What is thetaProperties?
- I guess the gamma field is part of the VOF method explained in the ..etc and bla bla section
- Line 3: In order to be able to retrive..
  Why is this necessary and what are you trying to say?
- Last sentence:
  Tense
  What are you trying to say? Elaborate or remove this part.

### 2.5.2 Material Properties

- Fix heading
- No table caption
- Table makes no sense at all, is the initial condition gravity for enviromentalProperties ?
- Is the transport model the viscosity model?
- List one phase and describe what the none trivial parts mean. Skip rest of file or put in appendix
- Last sentence: Values for sigma are all 0.7
  In `transportProperties` it says 0.07?

### 2.5.3 Solver Control

- Fix heading
- Explain setFieldsdict
  The setFields utility uses setFieldsdict to... setFieldsdict.. box.. defines location and geometry of a specific phase
- Line 2: ..placed phases is defined.
  are defined

## 2.6 Defining your own Viscosity Model

- Line 1: The provided HerschelBulkley...
  How is this better for us?

***This whole section does not work at all, the author need to add <u>at least</u> the following***

```
cd $WM_PROJECT_DIR
cp -riuv --parents --backup src/transportModels/incompressible/ \
$WM_PROJECT_USER_DIR
cd $WM_PROJECT_USER_DIR/src/transportModels/incompressible/viscosityModels/
cp -r HerschelBulkley myHerschelBulkley
```

Change HerschelBulkley to my myHerschelBulkley in the .C and .H file using sed and rename the files to my myHerschelBulkley.

```
cd myHerschelBulkley
sed s/HerschelBulkley/myHerschelBulkley/ \
<HerschelBulkley.C >myHerschelBulkley.C
sed s/HerschelBulkley/myHerschelBulkley/ \
<HerschelBulkley.H >myHerschelBulkley.H
rm HerschelBulkley.C HerschelBulkley.H
```

Check in `myHerschelBulkley.C` so all "HerschelBulkley" have been replaced with "myHerschelBulkley"
Save and change directory to:

```
cd $WM_PROJECT_USER_DIR/src/transportModels/incompressible/Make
```

and open the `files` file. Add the following line just below the existing viscosity models:

```
viscosityModels/myHerschelBulkley/myHerschelBulkley.C
```

Compile your library

```
cd $WM_PROJECT_USER_DIR/src/transportModels/incompressible
wmake libso
```

Make changes to the `transportProperties` so you use your myHerschelBulkley viscocity model, copy the coefficient from the original HerschelBulkley viscocity model.

```
crete
{
    transportModel   myHerschelBulkley;
    nu              nu [0 2 -1 0 0 0 0]  1;
    rho             rho [1 -3 0 0 0 0 0] 2000;

    myHerschelBulkleyCoeffs
    {
    tau0            tau0 [0 2 -2 0 0 0 0] 0.0;
       k               k [0 2 -1 0 0 0 0] 0.001;
       n               n [0 0 0 0 0 0 0] 1;
       nu0           nu0 [0 2 -1 0 0 0 0] 10e5;
    }
}
```

Check when you start the `multiphaseInterFoam` solver that your viscosity model is being used.

```
.
.
Create time
Create mesh for time = 0
Reading environmentalProperties
Reading field pd
Reading field U
Reading/calculating face flux field phi
Selecting incompressible transport model Newtonian
Selecting incompressible transport model myHerschelBulkley
Selecting incompressible transport model Newtonian
Calculating field g.h
.
.
.
```

## 2.7 Solving the Case

- Line 1: The OpenFOAM solver multiphaseInterFoam is used to resolve..
  Do not use resolve, simulate or calculate
- Line 2: See previous comments about gamma.
- Line 4: This will take a while :)
  Are you kidding me? A "while" is not informative and the added smiley does not help at all. Should I start the calculation on a 1000 node cluster or a PalmPilot?
  The calculation will take approximately 2 minutes on a Intel Dual-Core 2.3GHz with 4GB ram.

## 2.8 Post-processing

- Line 1: The application is started automatically launching the solution data commanding.
  What do you mean?

- Line 3: Select the alphas option to view the phases
  Create a cut plane and color by alphas.
- Remove screenshoot of paraview, or at least the upper Ubuntu bar.
- Missing figure caption

## 2.9 Changing the transportProperties

- ..after a computation time of 0.2 s
  the solution a t=0.2 s

## 2.10 Adding another Phase

- Line 1: One may wish to 'age'...
  To simulate an 'aged' concrete, meaning...
- Line 7-13
  Rewrite the whole part so it is possible to follow what you are doing both in- and outside the code.
- Last line: Have fun!:)
  This is a report, not a postcard to your friends or family.