

# **MEng Project Log**

by

Jincong Li

M.Eng, The University of British Columbia, 2024

8th May, 2024

© Jincong Li, 2024

# Contents

<b>1</b>	<b>8th May</b>	<b>6</b>
<b>2</b>	<b>9th May</b>	<b>6</b>
<b>3</b>	<b>10th May</b>	<b>6</b>
3.1	Important Functions . . . . .	6
3.2	Case 1: Lid Driven Cavity . . . . .	7
3.3	Files . . . . .	7
3.4	Multiprocess . . . . .	7
<b>4</b>	<b>13th May</b>	<b>7</b>
4.1	Steps to Simflow . . . . .	8
4.2	Case4: Complie . . . . .	8
4.3	Multiphase . . . . .	8
<b>5</b>	<b>14th May</b>	<b>8</b>
5.1	Sockeye . . . . .	9
5.2	Submit job . . . . .	9
<b>6</b>	<b>15th May</b>	<b>9</b>
<b>7</b>	<b>16th May</b>	<b>9</b>
<b>8</b>	<b>21th May</b>	<b>9</b>
<b>9</b>	<b>22th May</b>	<b>9</b>
9.1	Output . . . . .	9
9.2	Initialization of multiphase . . . . .	10
9.3	Killing waves . . . . .	10

9.4 multiple jobs . . . . .	10
<b>10 23th May</b>	<b>10</b>
10.1 Work for DTMB5415 . . . . .	10
<b>11 24th May</b>	<b>11</b>
11.1 Work . . . . .	11
<b>12 27th May</b>	<b>11</b>
12.1 Work for DTMB5415 . . . . .	11
<b>13 28th May</b>	<b>12</b>
13.1 Work for DTMB5415 . . . . .	12
<b>14 3rd June</b>	<b>12</b>
14.1 Work for DTMB5415 . . . . .	12
14.2 Work for wave . . . . .	12
14.3 Meeting with Dr.Rajeev . . . . .	12
<b>15 4th June</b>	<b>13</b>
15.1 Work for DTMB5415 . . . . .	13
15.2 Work for wave . . . . .	13
<b>16 5th June</b>	<b>13</b>
16.1 Work for DTMB5415 . . . . .	13
<b>17 6th June</b>	<b>13</b>
17.1 Work for wave . . . . .	13
<b>18 7th June</b>	<b>13</b>
18.1 Work for wave . . . . .	13

<b>19 13th June</b>	<b>14</b>
19.1 Work for structural modes . . . . .	14
19.2 Work for waves . . . . .	14
<b>20 14th June</b>	<b>14</b>
20.1 Work for DTMB5415 . . . . .	14
<b>21 17th June</b>	<b>14</b>
21.1 Work for DTMB5415 . . . . .	14
<b>22 18th June</b>	<b>15</b>
22.1 Work for DTMB5415 . . . . .	15
<b>23 19th June</b>	<b>15</b>
23.1 Work for DTMB5415 . . . . .	15
<b>24 20th June</b>	<b>15</b>
24.1 Work for DTMB5415 . . . . .	15
<b>25 24th June</b>	<b>15</b>
25.1 Work for DTMB5415 . . . . .	15
<b>26 2nd July</b>	<b>16</b>
26.1 Work for DTMB5415 . . . . .	16
<b>27 3rd July</b>	<b>16</b>
27.1 Work for DTMB5415 . . . . .	16
<b>28 4th July</b>	<b>16</b>
28.1 Work for DTMB5415 . . . . .	16
<b>29 5th July</b>	<b>17</b>

29.1 Work for DTMB5415 . . . . .	17
<b>30 7th July</b>	<b>17</b>
30.1 Work for DTMB5415 . . . . .	17
<b>31 10th July</b>	<b>17</b>
31.1 Work for DTMB5415 . . . . .	17
<b>32 15th July</b>	<b>18</b>
32.1 Work for DTMB5415 . . . . .	18
<b>33 16th July</b>	<b>18</b>
33.1 Work for DTMB5415 . . . . .	18
<b>34 18th July</b>	<b>18</b>
34.1 Work for DTMB5415 . . . . .	18
<b>35 19th July</b>	<b>19</b>
35.1 Work for DTMB5415 . . . . .	19
<b>36 22th July</b>	<b>19</b>
36.1 Work for DTMB5415 . . . . .	19
<b>37 23th July</b>	<b>19</b>
37.1 Work for DTMB5415 . . . . .	19
<b>38 24th July</b>	<b>19</b>
38.1 Work for DTMB5415 . . . . .	19
<b>39 26th July</b>	<b>20</b>
39.1 Work for Split Outlet . . . . .	20
<b>40 29th July</b>	<b>20</b>

40.1	Work for DTMB5415 . . . . .	20
40.2	Meeting notes . . . . .	20
40.3	Day 12 . . . . .	20
<b>41</b>	<b>30th July</b>	<b>21</b>
<b>42</b>	<b>31th July</b>	<b>21</b>
<b>43</b>	<b>1st Augusst</b>	<b>21</b>
43.1	Day 9 . . . . .	21
<b>44</b>	<b>2st Augusst</b>	<b>22</b>
<b>45</b>	<b>5th Augusst</b>	<b>22</b>
<b>46</b>	<b>6th Augusst</b>	<b>22</b>
<b>47</b>	<b>7th Augusst</b>	<b>22</b>

## **1 8th May**

1. Applied for the access to ICICS 227
2. Applied for the access to compute Canada

## **2 9th May**

1. Installed Gmesh, Paraview and get access to compute canada
2. Read Eigenfrequency analysis from COSMOL
3. Learn how to use Gmesh: geometry part and the mesh part with two case: vertical plane and cylinder
4. Install the Simflow

## **3 10th May**

### **3.1 Important Functions**

1. simflow : run simflow to solve
2. mpirun -nx simflowOmpi -npx
3. simGmshCnvt -msh \*.msh :mesh
4. simPlt -type vtk : post processing
5. gmsh -3 : convert geo to msh
6. cd (home) . (current) .. (previous)
7. vi :q :w :q! : quit, write, write&quit, and quit without saving
8. cp (source) (destination) :copy
9. mv (source) (destination) :move
10. scp :copy from others computer
11. rm -r (folder)
12. scp -r ineogi@beluga.computecanada.ca: /scratch/CavityTutorial .
13. scp conroyli@beluga.computecanada.ca: /scratch/CavityTutorial/debug1/\*.vtk .

### 3.2 Case 1: Lid Driven Cavity

1. 10 time steps with 0.1s
2. saved in 'debug1'
3. which simflow :give the location of the first version of simflow
4. /simflow-Nihar/bin/simflow
5. vi simflow.config
6. simPlt -type vtk -min 0 -last 10 in CavityTutorial

### 3.3 Files

1. cavity.geo
2. cavity.msh : save as msh
3. .crd .cnn .nbc (nodal BC) .srf
4. cavity.def
5. eightNodeBrick sixNodeWedge fourNodeTech
6. simGmshCnvt -msh Case1.msh

### 3.4 Multiprocess

1. InteractiveNode
2. salloc -ntasks=16 -account=def-rjaiman -time=1:0:0 -mem-per-cpu=4G
3. squeue
4. multiple cpu task: simflow.config
5. mpirun -n 16 /simflow-Nihar/bin/simflowOmpi -np 16

## 4 13th May

1. Fix Case1 files -> the problem should be in the mesh file
2. Check email for the lab access
3. Run Case2: sucessfully run and the vortec shedding is observed
4. Run Case3: VIV case with movable cylinder, follow the code project 1 article and try to reproduce the results.
5. Run Case4: wave-run-up case



## 4.1 Steps to Simflow

1. Mesh - Geometry - 3D/2D w 1 layer thick - physical groups - nbc srf - Mesh.MshFileVersion = 2.13;
2. Def file - geo -> msh - simflowCnvt
3. Post processing:
4. scp conroyli@beluga.computecanada.ca:/home/conroyli/scratch/Case1-plate/debug1/\*.vtk  
.
5. Paraview :vtk
6. MATLAB: Oisd Othd
7. Restart Simflow: Rst
- 8.

## 4.2 Case4: Complie

1. src - solbc.c - change the height.. - save and "make" in src
2. make clean to clear
3. make again
4. def - userdefined
- 5.

## 4.3 Multiphase

1. Allen-Calm (Phase field)
2. order parameter =  $\phi$  from -1 to 1 (air to water)
3. src-solpro.c

## 5 14th May

1. /scratch/st-jelovica-1/ljc2018/
2. ljc2018@sockeye.arc.ubc.ca cwl password
- 3.

## **5.1 Sockeye**

1. make clean
2. cp ../src-cc/src/y.\* .
3. make

## **5.2 Submit job**

1. computecanadajob.sh
2. sbatch
3. make

## **6 15th May**

1. Case 4 wave-run up submitted
2. Case 3 VIV case submitted

## **7 16th May**

1. Case 3 VIV case with corrected parameters submitted

## **8 21th May**

1. N/A

## **9 22th May**

### **9.1 Output**

1. oisd → Integrated Force
2. othd → Nodal Time History
- 3.

## 9.2 Initialization of multiphase

1. x is the longitudinal, z is up and down
2. solProc.c line 377  $3i+2$  is the z coord, need + or -1
- 3.

## 9.3 Killing waves

1. Method 1: ship at 0.25 L of the domain and l as the ship length, domain: 15-20l and 5l for the very coarse
2. fine mesh in front, very coarse at the end
3. Method 2: solTimeInteg
4. damploc → start location of damping
- 5.

## 9.4 multiple jobs

1. change simMakeInp → run simMake → make: compile c++ → simflow and simflowOmpi
2. make clean + copy y files
3. Wavetank:  $L=15+5m$ ,  $H = 6m$ ,  $W = 8m$
- 4.

Task: examine waves from 0.2-2m Jobs: height 0.8m & 1.6m and wave length 1m & 2m

1. 1: 0.8 & 1
2. 2: 0.8 & 2
3. 3: 1.6 & 1
4. 4: 1.6 & 2

# 10 23th May

## 10.1 Work for DTMB5415

1. Question: wave case not reasonable

2. Load the DTMP5415 ship model into gmsh
3. reverse it in the x-direction to have the head of the ship facing -x
4. scale the model down into 1:24.83 according to the Varhiala's thesis
5. re-run the testing case2 for the wave in 100 ts and 5 outFre to see if the input wave is functioning
6.  $L_{pp} = 5.72 \text{ m}$  x→ -8m and 12m y→ +-10m z→ +-8.49/2m
7. 4 tests for wave are discard, new test with height = 0.5m and 3 1 3 "test5"
8. test5 failed → need to ask Ishan

## 11 24th May

### 11.1 Work

1. Question: how is the depth of the water defined in the solBc.c
2. need to consider the distance between the bottom of the model and the origin point
3. free surface to bottom of the ship is 0.248m
4. need to sizefield the mesh
5. wave is generated correctly now but to see if the amplitude is correct → Test6: 2000 time steps
6. mesh problem is solved, now need to refine the mesh according to the thesis
7. origin of the ship to the lowest point is 0.12m, so the wave should be generated at  $0.284 \text{ m} - 0.12 \text{ m} = 0.164 \text{ m} + 2.46 \text{ m (min z)} =$
8. stp file needed in sockeye system? → use the msh file generated in Gmsh
9. how to control the Output? → timehistory
10. definition file? ALE and Multiphase together? → yes, all three together

## 12 27th May

### 12.1 Work for DTMB5415

1. makeup the definition file for DTMB 5415 ship simulation
2. copy from previous def files

3. solvesquence mode? dynamic or transient
4.  $U_{\text{inf}}$  is computed from Re to be 1.86515, so that the time step is 0.01s.
5. name of the mesh motion?
6. all Y to zero?
7. done modifying the definition file
8. msh conversion failed → ask Ishan

## 13 28th May

### 13.1 Work for DTMB5415

1. fix the msh and related files
2. wave height  $H_w$  is computed to be  $LPP * 0.056 = 0.32032$
3. wave number ?  $k_w$  is  $\frac{2\pi}{LPP} = 1.09845$
4. time period of wave  $T_w$  is  $\frac{0.629 * LPP}{U_{\text{inf}}} = 1.929$
5. salloc –nodes=1 –account=st-jelovica-1 –time=1:0:0 –mem-per-cpu=4G
6. change the type of element on the srf to be threenodetriangle

## 14 3rd June

### 14.1 Work for DTMB5415

1. fix the DTMB5415 simulation
2. need to change the dir of Open MakeFile and change SIMFLOW-HOME to your directory

### 14.2 Work for wave

1. wave case test 7 with the src files given by Ishan for 100 timesteps → the test is success, the input is good
2. test 8 for longer times to see the damp out, 4000 steps with 200 out → run again

### 14.3 Meeting with Dr.Rajeev

1. next meeting on June 09 for industry

## **15 4th June**

### **15.1 Work for DTMB5415**

1. examine the result of DTMB test and test 8 and the TDP test.
2. more info on <http://www.simman2008.dk/5415/5415-geometry.html>

### **15.2 Work for wave**

1. run the test 8 again with 4000 steps → still not working
2. `simPlt -type vtk -min 0 -last 10`

## **16 5th June**

### **16.1 Work for DTMB5415**

- 1.

## **17 6th June**

### **17.1 Work for wave**

1. the wave is correct in the wave run up case
2. so now, run the wave tank case with the same src file for test 9 and change the depth of the water as test 8
3. 1118420 is the 3m (test 8) → 1120985
4. 1118455 is the test 9 with the same solBc.c files with the wave run up case → 1120952

## **18 7th June**

### **18.1 Work for wave**

1. test 8 and 9 are both success
2. now need new tests for 1. wavelength 1 and everything else same → test1

3. 2. wave period 1 and everything else same → test2
4. 3. wave period 2.5 and everything else same → test3

## **19 13th June**

### **19.1 Work for structural modes**

1. got the Inp files
2. create the folders
3. run
4. run
5. comment out solTimeInteg.c line 530 damping codes
- 6.

### **19.2 Work for waves**

1. comment out solTimeINteg.c line 530 damping codes

## **20 14th June**

### **20.1 Work for DTMB5415**

1. test for not moving ship to see if the domain is correct

## **21 17th June**

### **21.1 Work for DTMB5415**

1. test submitted last friday failed, need to check the boundary conditions in the definition file.
2. change dynamic to transient and reduce the iteration for non-linear calculation → re-run the test

## **22 18th June**

### **22.1 Work for DTMB5415**

1. examine the test submitted yesterday → tmr
2. use exactly the same definition file from the wave Tank case to see the difference → NmTest3 → failed
3. test 4 with my modified definition file → sim succeed → problem caused by highFreDampingFac?

## **23 19th June**

### **23.1 Work for DTMB5415**

1. since no error shown in the simflow, need to ask Ishan → ask Xiaoyu
2. since the simple waveTank case is success, Xiaoyu suggests to change piece by piece from the waveTank case to the ship case
3. so here is the procedure:
4. put the ship into the waveTank case domain run the sim see the result
5. need test 5 to see the effect of highFreDampingFac → need to ask xiaoyu

## **24 20th June**

### **24.1 Work for DTMB5415**

1. shift-x tests → move the entire domain to have the origin located at the inlet surface does not work
2. do not use simflowOmpi-DTMB use the same simflow exe as the waveTank case → test 6 (1316325)

## **25 24th June**

### **25.1 Work for DTMB5415**

1. want to see the effect of changing the domain



2. reduce y to 4m tests → reduce-y-test1 succeeded, not failing with simflow-1
3. with simflow-DTMB → test2

## **26 2nd July**

### **26.1 Work for DTMB5415**

1. `simGmshCnvt -msh *.msh`
2. `/* Hard code for inlet wave run-up */`
3. `H-wave = 0.32032 ; /* Wave height */`
4. `D-water = 3.0 ;//2.624 ; /* Water depth */`
5. `T-wave = 1.929; /* Wave period */`
6. `L-wave = 0.9108 ; /* Wave length */`
7. `PI = 3.14159265 ;`
8. `G = 9.81 ;`

## **27 3rd July**

### **27.1 Work for DTMB5415**

1. sockeye is not available currently
2. working on beluga
3. modifying files and setting up the sim

## **28 4th July**

### **28.1 Work for DTMB5415**

1. check the sim set up yesterday
2. DTMB5415 Tank test1 failed
3. increase y test succeed
- 4.

## **29 5th July**

### **29.1 Work for DTMB5415**

1. check the sim set up yesterday
2. need to check the moving case
3. try DTMB5415 moving (increase y) test2 with inertia and stiffness set to 1 → pending
- 4.

## **30 7th July**

### **30.1 Work for DTMB5415**

1. refine the mesh near the ship
2. ask for the ALE definition file from Ishan
3. why ale is not moving ?
4. how to track the heave response of the ship? probe on the ship? coordinates?
5. how to track the vertical fluid force?
6. try DTMB increase y test 2 with wave set up in the thesis
7. now the DTMB means the wave set up in the thesis
8. wave test set up is "wavetest"

## **31 10th July**

### **31.1 Work for DTMB5415**

1. test Gabin's file
2. check the calculation from the Vaibhav thesis
3. use the given definition file to run the simulation

## **32 15th July**

### **32.1 Work for DTMB5415**

1. back to work on sockeye
2. moving with given def file test1 with reduced y domain and wave test conditions
3. -> failed -> need to find the issue -> failed

## **33 16th July**

### **33.1 Work for DTMB5415**

1. use the matchmeshvelocity in my definition file
2. still internal error

## **34 18th July**

### **34.1 Work for DTMB5415**

1. after ask Xiaoyu
2. within DTMB-M-reducey
3. Test1 make all non linear iteration to be 1 and see what is wrong here (time step =10) -> 10 steps sucessd -> run for longer time (test1-1) -> failed after 73 steps (chaos) probably wrong with the inlet velocity
4. Test2 make it not moving again to see what is wrong in the given (rigid.def) definition file (/DTMB5415-NM-reduce-y-Test3)
5. remove the initial inlet velocity -> DTMB-moving-reducey-test2 (1501309) -> make 4000 steps and 80 out Fre - DTMB-moving-reducey-Test3 (1501430)
6. xiaoyu suggested to test the not moving case with just a current not a wave and then turn it into a wave so see if the problem is in the ALE, boundary conditions, or the domain itself.
7. add the inlet velocity and fix the ale ship Z motion -> DTMB-moving-reducey-test4

## **35 19th July**

### **35.1 Work for DTMB5415**

1. re-build simflow-DTMB

## **36 22th July**

### **36.1 Work for DTMB5415**

1. inspired by Ishan, no inlet velocity, hydrostatic outflow to be off, tune a outflow velocity, with the damping off as well, with DTMB wave condition → DTMB-moving-reducey-test5(1526607)
2. test5 succeed without error, but the water is too deep and is draining out since the outlet velocity is too high (?), so reduce the water depth and out velocity to be 1.0 → Test6
3. 1.0 outflow velocity is still too fast →? reduce to 0.5 → test7 –
- 4.

## **37 23th July**

### **37.1 Work for DTMB5415**

1. test7 is still draining out, the outlet velocity should be related to the size of the domain as well
2. test8 with 0.3 outflow velocity
3. test9 with the test wave condition for seeing if the chaos remains (1538065)
4. at the same time, run a test1 with increased y using the same def file and test wave conditions

## **38 24th July**

### **38.1 Work for DTMB5415**

1. according to Ishan, chaos could be solved by increasing the domain length and have coarser mesh at the end → DTMB-M-increas-xy series of tests

2. → test 1 with 2000 ts and DTMB wave condition → failed neg jacobian → adjust the mesh and turn on the damping

## **39 26th July**

### **39.1 Work for Split Outlet**

1. Split outlet test1, created the domain as stated by Ishan and convert the mesh
2. modify the definition file and using the test wave condition, highFreDampingFac to be 0.5 and 1000ts and 20 out freq
- 3.

## **40 29th July**

### **40.1 Work for DTMB5415**

1. Xiaoyu suggest uniform inflow and outflow with finer mesh at the end

### **40.2 Meeting notes**

1. presentation information details
2. project results and reports
3. jobs, asked seaspan
4. document all the waves, validated the results

### **40.3 Day 12**

1. Do the spring case instead of having the hydrostatic outflow off → with wave test condition 1632540(with transient mode) → neg jacobian → enlength the domain and turn on the damping and have coarse mesh at the end
2. check the definition files from the VIV case and the wave tank case → body center needs to confirm and need to choose the output node → output code solved → All done
3. tune for stiffness
4. chop the steps to see what is wrong

5. build the wave tank domain again as well the ship domain to be same so they could be replaced easily → domain size 3m in y&z and 14m in x →built
6. need to test my geo for wave tank 1610900 → success
7. confirm the original wave tank case works mpirun -n 128 simflow-1Ompi -np 128 >run.log (1610829→1614464) -> done and success
8. test for vaibhav wave conditions → tnr
9. prepare the slides and the report
10. renew solidworks?
11. src/preProcCmd to check output code

## **41 30th July**

1. exam both wave tank case → both works
2. use wave tank case to see test vaibhavwave condition and depth of the water →1632733 with myWTcase and DTMB wc →it works, now just need to exam the ale def file
3. continue find the paper of DTMB and revise the sims of not moving ship
4. test the my WT case with ale def (moving waveTank) →1632377→failed →neg jacobian →test 2 with new domain
5. domain enlengthed to 3x3x20 damping happens from 10 and adjust the mesh to have coarser mesh at the end
6. dampLoc = 10m end =20m

## **42 31th July**

1. 1677005

## **43 1st Augusst**

### **43.1 Day 9**

1. 1677005 is the no damping executables
2. moving wave tank test 2 succeded with no error but the box is moving higher and higher

## 44 2st Augusst

1. for the movign wave tank case, try larger mass or reduce the stiffness → MovingWT test3 & and adjust the water depth of the order bar → this is done
2. increase the stiffness and modify the wave equations
3. DTMB test3 with updated wave equation, and larger stiffness, also turn off the gravity
4. try run the moving wave tank case for much more longer time
5. try airy wave tonight
- 6.

## 45 5th Augusst

1. the heave motion of the ship is not perfect sinusoidal even after have much more finer mesh near the ship
2. try airy wave or ? and reduce the stiffness a little bit

## 46 6th Augusst

1. no difference in the airy wave or stokes wave
2. amplitude is still too low → reduce stiffness
3. sth wrong with the wave length → build simflow-Dwl (DTMB wave length corrected)→ finer test 5
4. maybe need to consider the structural inertial
5. try the damping function again → simflow-wd (with damping)
- 6.

## 47 7th Augusst

1. the damping function is breaking the simflow → ask Ishan for fixing It
2. 5.72m stokes wave makes the responce ugly → try airy wave test6
3. test 7 for the ineria value vaibhav has