

CFD SOFTWARE LAB

PURPOSE: The purpose of this lab is to give you some experience with CFD software. For it you will set up a simulation for a floating body in a wave tank.

PROCEDURE: Create a CFD mesh of a wave tank. Import the STL file for a body into the mesh. Set the simulation parameters. Run the simulation to get the motion of the body step by step in time. Produce an animation of the motion.

REPORT: Describe the steps you took to do the CFD. Present the most important menus used by the simulation. Present the animation results. Discuss the results.

CFD LAB STEPS

(1) Click on the FLOW 3D icon to get to Navigator. (2) Under Navigator create new workspace on desktop. (3) Under Navigator create new simulation on desktop. (4) Click on Model Setup to get its submenus. (5) Under General set things like free surface. (6) Under Physics activate things like GMO. (7) Under Fluids load data for water. (8) Under Mesh Setup create the mesh. (9) Under Mesh Setup import body STL file. (10) Scale and translate body to fit mesh. (11) Under Boundaries set boundary types. (12) Under Initial set things like speeds. (13) Under Output set data spacing. (14) Under Numerics click on one fluid with interface. (15) Under Simulation click on run. (16) Under Analyze click on 3D probe. (17) Expand time and click on STL and Render. (18) Click on animation.

General

Finish time10.0

Finish condition

Restart

Interface tracking

☒ Free surface or sharp interface

☐ No sharp interface

Flow mode

☒ Incompressible

☐ Compressible

☐ Steady-state accelerator

(Non-physical transients)

Number of fluids

☒ One fluid

☐ Two fluids

Mentor options

☐ No mentor help

☐ Offer suggestions

☒ Offer suggestions and take action

Units

Simulation units

SI

Version options

VersionDouble precision (Default)

Number of processorsAll Available (Default)

☐ Run serial code if parallel tokens in use (Default)


Reset to Defaults

Notes

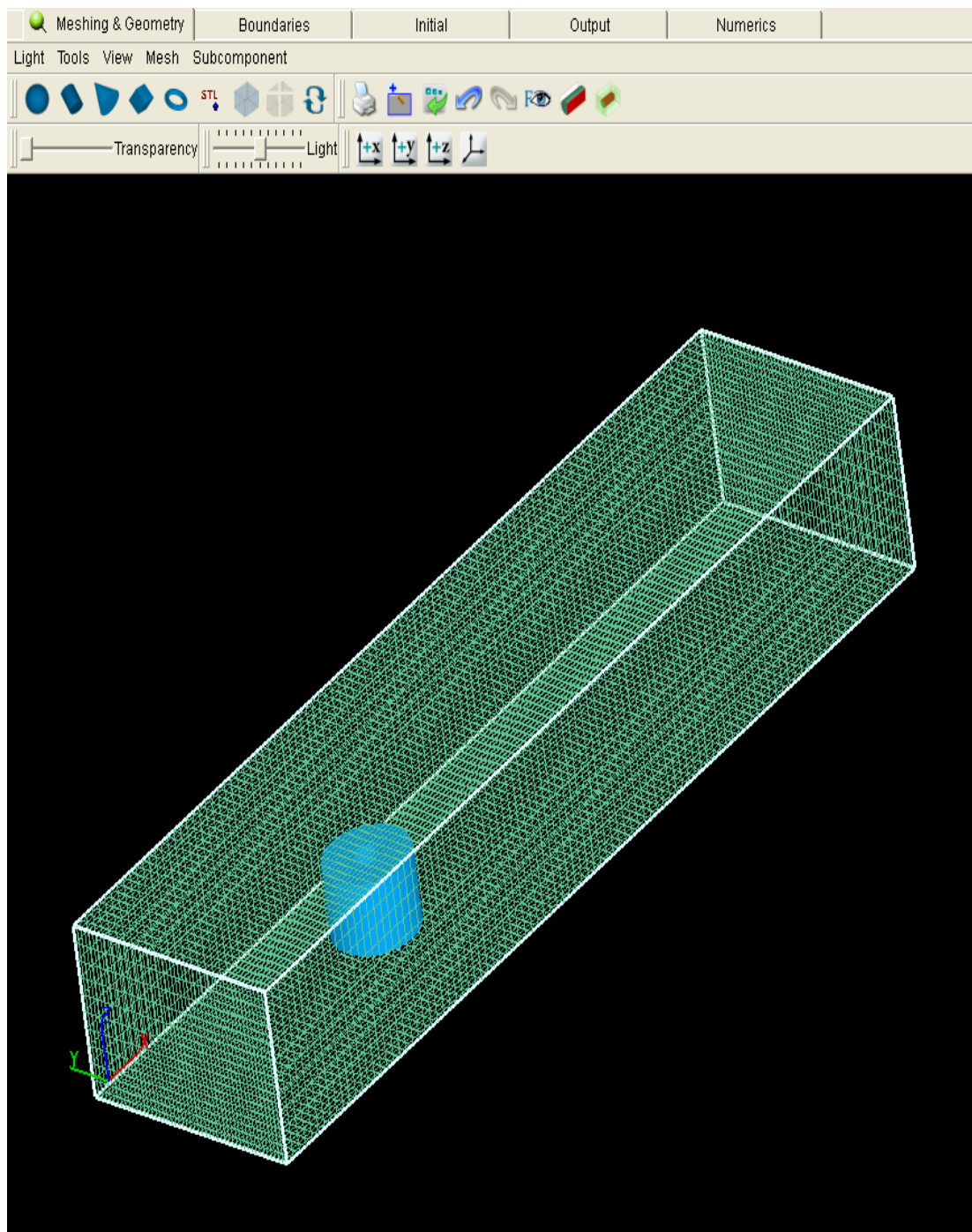
Font...

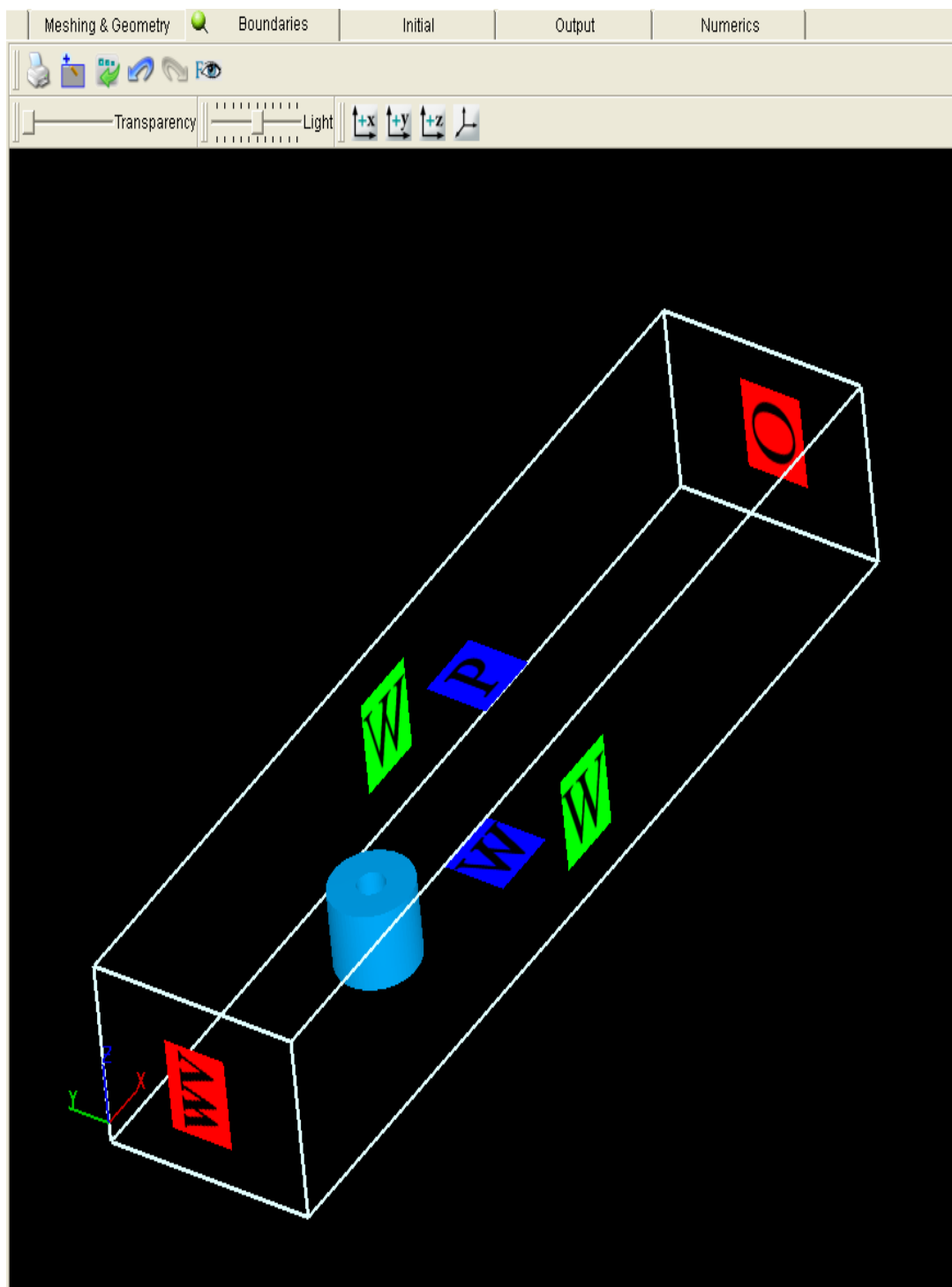
float in waves

[-] Geometry

- [+] Global
- [-] Component 1 
 - Name
 - Material Name
 - Component Type
 - [-] Subcomponent 1: C:\Documents and Settings\mhinchey\Desktop\float.STL
 - Geometry File ->
 - Name
 - Subcomponent Type
 - [+] Min/Max
 - [-] Transformations
 - [-] Magnifications
 - Global
 - X
 - Y
 - Z
 - [+] Rotations
 - [-] Translations
 - X
 - Y
 - Z
 - [+] Limiters
 - Mass Density
 - Contact Angle
 - [-] Type of Moving Object
 - Moving Object Properties
 - [+] Type of Deforming Object
 - [+] Collision Properties
 - [+] Solid Properties
 - [+] Surface Properties
 - [+] Initial Conditions
 - [+] Electrical Properties
 - [+] Core Gas Model Properties
 - [+] Lost Foam Properties
 - [+] Porous Properties
 - [+] Output
- Baffles
- Springs and Ropes

- Baffles
- Springs and Ropes
- ☐ Mesh - Cartesian
 - ☐ Block 1
 - ☐ X Direction
 - Total Cells
 - ☐ Fixed Pt.(1)
 - Cell Size
 - # of Cells
 - ☒ Fixed Pt.(2)
 - ☐ Y Direction
 - Total Cells
 - ☐ Fixed Pt.(1)
 - Cell Size
 - # of Cells
 - ☒ Fixed Pt.(2)
 - ☐ Z Direction
 - Total Cells
 - ☐ Fixed Pt.(1)
 - Cell Size
 - # of Cells
 - ☒ Fixed Pt.(2)
- ☒ Render Space





Mesh Block : #1 [Z Max Boundary]

Boundary type

☐ Symmetry ☐ Continuative ☒ Specified pressure ☐ Grid overlay
☐ Wall ☐ Periodic ☐ Specified velocity ☐ Outflow ☐ Volume flow rate

Velocities U velocity <input type="text"/> V velocity <input type="text"/> W velocity <input type="text"/>	Pressure <input type="text" value="0"/> <input type="checkbox"/> Stagnation pressure	F fraction <input type="text" value="0"/>
Density <input type="text"/> Solute concentration <input type="text" value="0.0"/>	Sediment concentration <input type="text"/> Scalars <input type="text"/>	Electric charge <input type="text"/> <input type="checkbox"/> Specified potential boundary Electric potential <input type="text"/>

Mesh Block : #1 [X Min Boundary]

Boundary type

☐ Symmetry ☐ Continuative ☐ Specified pressure ☐ Grid overlay ☒ Wave
☐ Wall ☐ Periodic ☐ Specified velocity ☐ Outflow ☐ Volume flow rate

Wave Definition

☒ Linear ☐ Stokes

Pressure <input type="text"/> <input checked="" type="checkbox"/> Stagnation pressure	F fraction <input type="text" value="1.0"/> Fluid height <input type="text" value="2.0"/>
Density <input type="text"/> Solute concentration <input type="text" value="0.0"/>	Sediment concentration <input type="text"/> Scalars <input type="text"/>

Linear Wave Definition

Wave attributes

Number of wave components: 1

Mean fluid depth: 2.0

	Amplitude	Period	Phase shift (degrees)
Wave component #1	0.1	2.5	0.0

Current velocities

X velocity:

Y velocity:

Linear Wave Definition

The wave is assumed to come from a flat bottom reservoir, which is outside the computational domain.

OK Cancel

Mesh Block : #1 [X Max Boundary]

Boundary type

☐ Symmetry
 ☐ Continuitive
 ☐ Specified pressure
 ☐ Grid overlay
 ☐ Wave

☐ Wall
 ☐ Periodic
 ☐ Specified velocity
 ☒ Outflow
 ☐ Volume flow rate

☒ Allow fluid to enter at outflow boundary

Pressure
 F fraction 1.0

☒ Stagnation pressure
 Fluid height -1.e10

Density
 Sediment concentration

Solute concentration 0.0
 Scalars

Electric charge
 Specified potential boundary

Electric potential

Moving object setup

Component 1

Motion Constraints
Mass Properties
Initial/Prescribed Velocities
Control Forces and Torques

Type of constraint

6 degrees of freedom

(In space system)

Fixed axis/point X coordinate
0.0

Fixed axis/point Y coordinate
0.0

Fixed axis/point Z coordinate
0.0

Limits for rotation
Maximum rotational angle (degrees)

Negative direction
Positive direction

Translational and rotational options
(In space system)
(In body system)

X translation
Coupled motion

Y translation
Coupled motion

Z translation
Coupled motion

X rotation
Coupled motion

Y rotation
Coupled motion

Z rotation
Coupled motion

Limits for translation
Maximum displacement of mass center

Negative direction
Positive direction

X displacement

Y displacement

Z displacement

OK

Cancel

Moving object setup

Component 1

Motion Constraints
Mass Properties
Initial/Prescribed Velocities
Control Forces and Torques

Define density

Mass density
500

Total mass

Moment of inertia about fixed axis

Initial mass center location

X in space system

Y in space system

Z in space system

Moment of inertia tensor about mass center in body system

J₁₁
J₁₂ (J₂₁)
J₂₂
J₁₃ (J₃₁)
J₂₃ (J₃₂)
J₃₃

$$\begin{bmatrix} J_{11} & J_{12} & J_{13} \\ J_{21} & J_{22} & J_{23} \\ J_{31} & J_{32} & J_{33} \end{bmatrix}$$

OK

Cancel

lab - FLOW-3D - [Initial]

FileDiagnosticsPreferenceUtilitiesSimulateMaterialsHelp

Navigator

Model Setup

Simulate

Analyze

Display

General

Physics

Fluids

Meshing & Geometry

Boundaries

Initial

Output

Numerics

Search

Initial

Global initial fluid state

U velocity

0.0

V velocity

0.0

W velocity

0.0

Temperature

Turbulent k.e.

Fluid rotation

Electric charge density

0.0

Initial solute concentration

0.0

Suspended sediment concentration

No sediments defined

Initial pressure field

Uniform pressure

Hydrostatic pressure in x-direction

Hydrostatic pressure in y-direction

Hydrostatic pressure in z-direction

Fluid 1 initialization options

Fill height (Z-direction)

0.0

Fluid volume

0.0

Void initial state

Pressure

0.0

Temperature

Add valve



Add fluid

Add temperature

Add fluid pointer

Add void pointer



 **FLOW-3D Results** 

☐ Existing ☒ Custom

Data file path

C:/Documents and Settings/mhinchey/Desktop/mjh/lab


[.]

[..]

[Temp]

flsgrf.lab

File name :

Files of type : FLOW-3D Data File (flsgrf*.*,prpgrf*.*) 

Drives : c:/ 