1495

UNIVERSITY OF ABERDEEN

OILTHIGH OBAR DHEATHAIN

DESIGN OF A SMART ISO TANK CONTAINER

EG5565 MEng Group Design Report

HAMAD ALSHAMSI	:	51988929
PIOTR RUCINSKI	:	12345678
EUAN THOIRS	:	51983427
MOHAMMED AHMED	:	51987991
MICHAEL ALLISON	:	12345678
PONTUS ANGERFORS	:	51987029

A dissertation submitted in partial fulfilment of the requirements of the award of Master of Engineering at the University of Aberdeen

(February 29, 2024)

Abstract

An abstract should be three-quarters of a page to a page of text, which introduces and motivates the project, describes how the project was conducted, describes the key results, and outlines the key findings and conclusions.

Contents

List of Figures

List of Tables

Chapter 1

Introduction

1.1 More detailed introduction

The page margins in this document have been set-up so that there is more space next to the binding, when the final document is assembled.

Following Hicks and Purvis (2010) we can add references to our text. References can be formatted in alternative ways to suit the location (Hicks and Purvis, 2010). Faßmann et al. (2013) and Yoon and Semenov (2011) also wrote a papers. These will automatically be correctly reordered and formatted (at least to an extent). In section 1.1.1 I will list the software you need to achieve this.

I can easily add more text and references Kaminski et al. (2014) and Abrahamsen and Faltinsen (2012).

1.1.1 Numbered lists and bullet point lists

To run LaTeX in Windows you need components:

- MikTeX - which is the language that does the typesetting;
- Texmaker - which is the editor;
- (Optional) Jabref - which is a bibliography database manager.

Alternatives software is available for Mac and Linux systems.

Numbered lists can also easily be created.

1. Item 1
2. Next item
3. Additional item

1.1.2 Equations

Newton's second law can be written as

$$F = m\frac{\mathrm{d}^2 y}{\mathrm{d}t^2}, \tag{1.1}$$

where F is the force on a body of mass m and position y. Equation (1.1) can now be easily referenced. Here we've used inline equations, which can be longer than single variables, i.e. $\cos^2\theta + \sin^2\theta \equiv 1$.

We can add a new equation

$$y = mx + c. \tag{1.2}$$

Here is a reference to equation (1.1)

Here is new sentence.

We can reference equations within a group of subequations. The two-dimensional Navier-Stokes equations for an incompressible Newtonian fluid are:

$$\frac{\partial u}{\partial x} + \frac{\partial v}{\partial y} = 0, \tag{1.3a}$$

$$\frac{\partial u}{\partial t} + u\frac{\partial u}{\partial x} + v\frac{\partial u}{\partial y} = -\frac{1}{\rho}\frac{\partial p}{\partial x} + \frac{\mu}{\rho}\left(\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2}\right), \tag{1.3b}$$

$$\frac{\partial v}{\partial t} + u\frac{\partial v}{\partial x} + v\frac{\partial v}{\partial y} = -\frac{1}{\rho}\frac{\partial p}{\partial y} + \frac{\mu}{\rho}\left(\frac{\partial^2 v}{\partial x^2} + \frac{\partial^2 v}{\partial y^2}\right), \tag{1.3c}$$

where the $(u,\, v)$ are the fluid velocities in the $(x,\, y)$ directions, p is the fluid pressure, ρ is the fluid density and μ is the fluid viscosity.

We can now reference all these equation (1.3), one of these equation (1.3a) or a subset of these equations (1.3b-1.3c).

Equations do not necessarily have to have numbers i.e.

$$F = m\frac{\mathrm{d}^2 y}{\mathrm{d}t^2},$$

but you should at least number all the key equations.

A whole range of formulae are possible including:

$$\frac{a+b}{c+d} = \epsilon, \tag{1.4}$$

$$\int_{-\infty}^{\infty} e^{-x^2}\mathrm{d}x = \sqrt{2\pi}. \tag{1.5}$$

These can involve Greek letters α, β, γ, δ, υ, ξ, η, μ, Δ, Π, random fonts $\boldsymbol{t}$, $\mathbb{T}$, $\mathcal{T}$, and other assorted mathematical squiggles $\aleph$, $\Rightarrow$, $\rightarrow$, $\odot$. Many more symbols can be found by Googling "latex symbols".

1.1.3 Figures

Figures can be added using the follow commands, and again are easy to reference - i.e. figure 1.1 shows ...

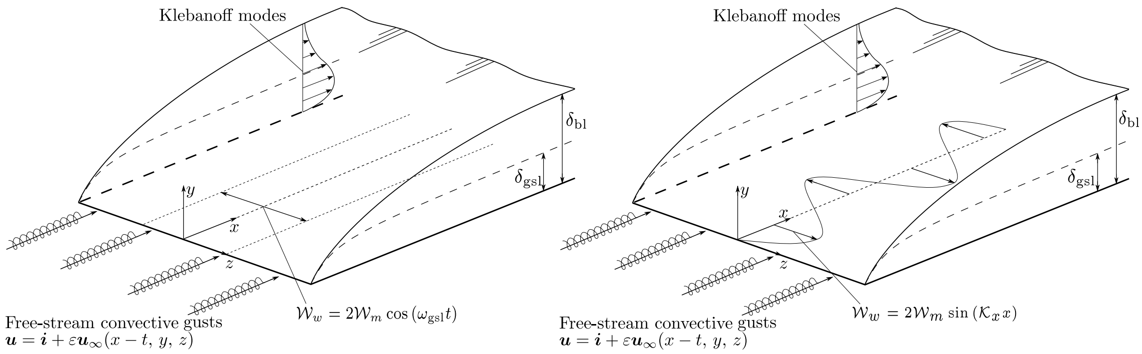

Figure 1.1: My first figure

1.1.4 Tables

Tables are more tricky, but will be familiar to anyone who has put a table on a website using `html`. References to tables follow a similar format - i.e. table 1.1 contains ...

Table 1.1: My first table

1	$y = x$	3
4	5	Cats
$\cosh^2\theta - \sinh^2\theta \equiv 1$	8	9

1.1.5 Recipes for soup

1.1.6 Reactions

In section 1.1.5 we had recipes for soup. Alaminos-Quesada et al. (2023) did not write about soup.

Chapter 2

Literature review

If I add a new chapter, section or subsection, then it is automatically included in the appropriate place in the table of contents.

2.1 An illustrated history of cheese

Write me.

2.1.1 Cheese is good

Write me. We can add a reference (Cates and Tjhung, 2018)

2.1.2 Help

Write me (Boffetta and Mazzino, 2017)

2.2 An illustrated history of wine

Wine is good - it goes well with cheese - see section 2.1

Chapter 3

Health & Safety Monitoring Simulator

3.1 Software development considerations

3.2 Software creation & results

3.3 Cloud development & architecture

3.4 Cloud test architecture

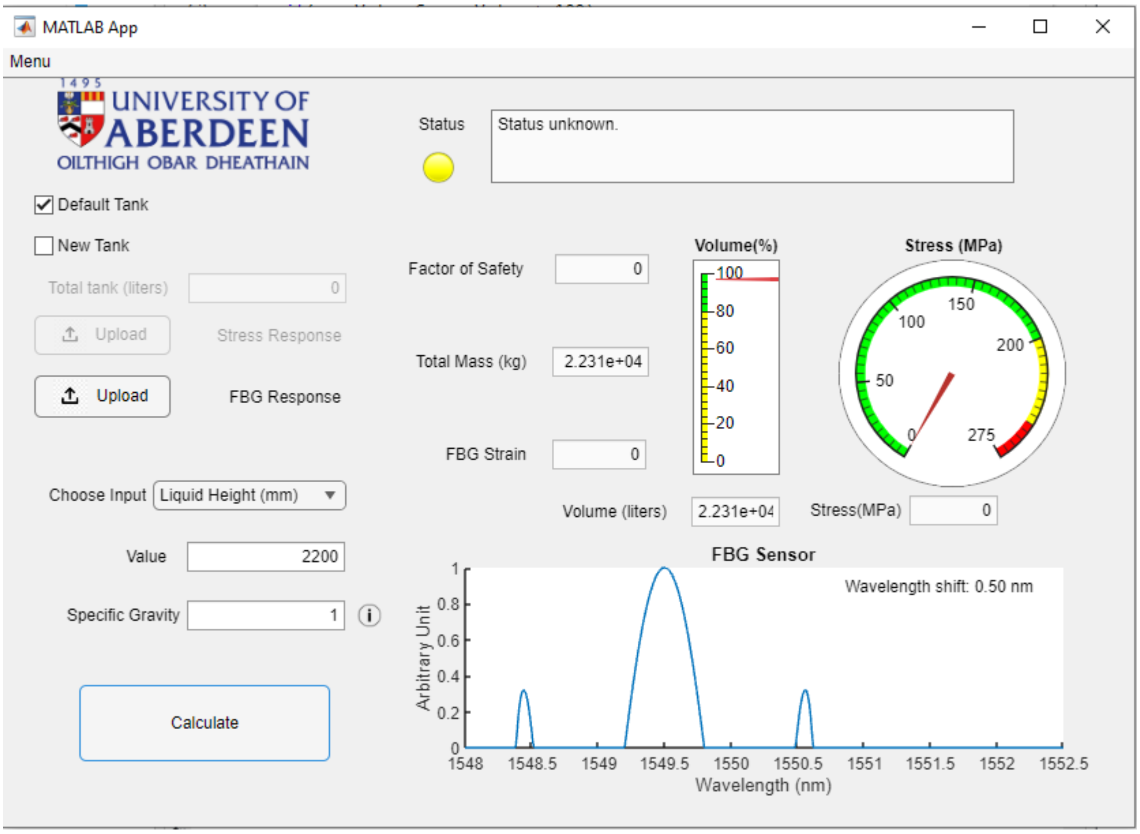

Figure 3.1: Application as of 29/02/2024. Github link: `https://github.com/prucinski/EG5565Simulator`

Chapter 4

Sensor Consideration

4.1 Electrical or Optical sensors

4.2 Optical sensor consideration

Appendix A

Matlab code

Description of Matlab code

A.1 Matlab code to solve a differential equation

Include a brief piece of text describing what the code does.

```
N = 10;                      % Number of grid points
x = linspace(0,0.5*pi,N);  % Setup the x grid
dx = x(2) - x(1);           % Set Delta x on a uniform grid Set Delta x on a uniform grid Set Delta x on a uniform grid Set Delta x on a uniform grid

y = zeros(N,1);    % Pre-allocate the solution vector
y(1) = exp(-1);    % Set the initial condition

for i = 1:N-1  % Loop over each point in the grid
  xhalf = 0.5*(x(i) + x(i+1));
  yhalf = y(i) + 0.5*dx*y(i)*sin(x(i));
  y(i+1) = y(i) + dx*yhalf*sin(xhalf);
end
```

Bibliography

Abrahamsen, B. C. and Faltinsen, O. M. (2012). A numerical model of an air pocket impact during sloshing. *Appl. Ocean Res.*, 37(0):54–71.

Alaminos-Quesada, J., Lawrence, J., Coenen, W., and Sánchez, A. (2023). Oscillating viscous flow past a streamwise linear array of circular cylinders. *J. Fluid Mech.*, 959:A39.

Boffetta, G. and Mazzino, A. (2017). Incompressible Rayleigh–Taylor turbulence. *Annu. Rev. Fluid Mech.*, 49(1):null.

Cates, M. E. and Tjhung, E. (2018). Theories of binary fluid mixtures: from phase-separation kinetics to active emulsions. *J. Fluid Mech.*, 836:P1.

Faßmann, B. W., Bansmer, S. E., Möller, T. J., Radespiel, R., and Hartmann, M. (2013). High velocity impingement of single droplets on a dry smooth surface. *Exp. Fluids*, 54(5):1–18.

Hicks, P. D. and Purvis, R. (2010). Air cushioning and bubble entrapment in three-dimensional droplet impacts. *J. Fluid Mech.*, 649:135–163.

Kaminski, A., Caulfield, C., and Taylor, J. (2014). Transient growth in strongly stratified shear layers. *J. Fluid Mech.*, 758.

Yoon, B. S. and Semenov, Y. A. (2011). Asymmetric impact of a two-dimensional liquid colomn. In Chatjigeorgiou, I. and Mavrakos, S. A., editors, *Proceedings of the 26th International Workshop on Water Waves and Floating Bodies, 17-20 April, Athens, Greece.*