The

Title of your Thesis Goes Here

by

Author Name

A Thesis submitted to Monash University

for the degree of

Doctor of Philosophy / Master of Engineering Science

Month 200?

Department of Mechanical Engineering

Monash Universty

For Someone You Might Wish to Dedicate Your Thesis To.

Statement of Originality

Here you should put a statement confirming the originality of your work.

e.g. “This thesis contains no material that has been accepted for the award of a degree or diploma in this or any other university. To the best of the candidate’s knowledge and belief, this thesis contains no material previously published or written by another person except where due reference is made in the text of this thesis.”

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If you want to be

a bit arty,

you might want to include,

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Abstract

Abstract goes here. This can be anything from a few paragraphs to a few pages. Normal "Abstract" standards apply here, i.e. no figures, avoid references, etc...

Acknowledgments

Acknowledgments here (don’t forget your supervisors!).

List publications from thesis here

SHEARD, G., THOMPSON, M.C. & HOURIGAN, K. 2003 Criticality and structure of the asymmetric vortex shedding modes of bluff ring wakes. *In proceedings of the 5th Euromech Fluid Mechanics Conference*, Centre de Congrès Pierre Baudis, Toulouse, France, August 2003.

SHEARD, G., THOMPSON, M.C. & HOURIGAN, K. 2003 From Spheres to Circular Cylinders: The Stability and Flow Structures of Bluff Ring Wakes. *J. Fluid Mech.* **492**, 147–180.

Blah, blah & blah, etc...

Nomenclature

List nomenclature here.

Symbol	**Description**
§	Thesis section
$\int$	Integration
∇	Vector gradient operator (grad)
∇^2	Del squared (or div grad) operator
$\sum_{i=a}^{b}$	Sum of arguments with j incrementing from a to b
α_1^A	Cubic saturation coefficient for Mode A amplitude in coupled Landau model
α_1^B	Cubic saturation coefficient for Mode B amplitude in coupled Landau model
α_2^A	Quintic saturation coefficient for Mode A amplitude in coupled Landau model
Γ_i	Inlet wall boundary of computational domain
Γ_o	Outlet boundary of computational domain
Γ_t	Outer transverse wall boundary of computational domain
Γ_{axis}	Wall boundary of axis of symmetry in computational domain
Γ_{ring}	Wall boundary of ring cross-section in computational domain
γ_1^A	Cubic coupling coefficient for Mode A amplitude in coupled Landau model
γ_1^B	Cubic coupling coefficient for Mode B amplitude in coupled Landau model
ΔE_i	i^{th} uncertainty in computations
ΔE_{tot}	Overall error in computations
Δx	Change in a given variable x
δ	Boundary layer thickness

Continued on the next page.

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Symbol	Description
η_{diff}	Landau diffusivity constant
θ	Azimuthal cylindrical polar coordinate
λ	Wavelength
λ_i	Wavelength based on i–scale
$\lambda_{i_{max}}$	Maximum wavelength based on i–scale
μ	Fluid viscosity, Floquet multiplier

Contents

Introduction

This chapter, the Introduction, does not have the section numbering of later chapters. This is a convenient way to separate the Introduction from the content/results chapters.

Note that the chapter and section control sequences have the form *nonumchapter*, *nonumsect*, etc.

Another Equation

An example of a figure with sub-figure components is shown in figure I.

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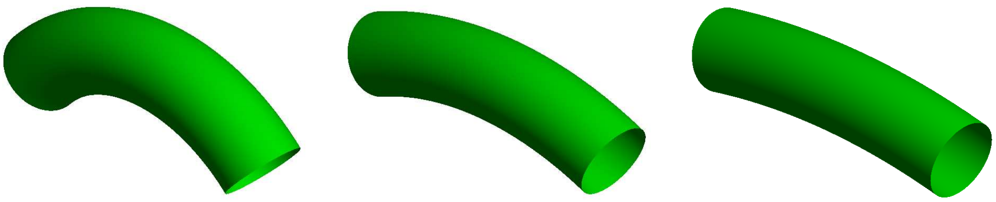

(a) $Ar = 5$, $K = 0.4$. (b) $Ar = 10$, $K = 0.2$. (c) $Ar = 20$, $K = 0.1$.

FIGURE I: Ring sections of various aspect ratio, elucidating the increased local similarity to a circular cylinder as the aspect ratio is increased.

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Chapter 1

A Review of the Literature

Literature review is included here.

1.1 A Section

Blah.

1.1.1 A Subsection

Reference papers by using the `\citet` command, which produces output like Stokes (1851), or the `\citep` command, which produces output like (Balachandar *et al.* 1997). If you want to display all author names (e.g. perhaps for the first instance in which they occur - common in journals such as Journal of Fluid Mechanics), use `\citet*`, which produces Thompson, Leweke & Provansal (2001).

To display the author name(s) only, use `\citeauthor`, e.g. "Fey *et al.*".

Chapter 2

Equations, Figures and Tables

This chapter contains examples of equations, figures and tables.

2.1 A Section Heading

Inline equations are produced by using \$ characters: e.g. `$A = bx$` produces $A = bx$.

2.1.1 A Subsection Heading

The equations directly below are generated using the `\BEQ` and `\EEQ` control sequences, which are defined in `Thesis.tex`. They are simply an abbreviation of the standard `\begin{equation}` and `\end{equation}`.

$$\left\{ \begin{array}{c} u(z,r,\theta,t) \\ v(z,r,\theta,t) \\ w(z,r,\theta,t) \\ p(z,r,\theta,t) \end{array} \right\} = \sum_{j=-J/2}^{J/2-1} \left\{ \begin{array}{c} u_j(z,r,t) \\ v_j(z,r,t) \\ w_j(z,r,t) \\ p_j(z,r,t) \end{array} \right\} \mathrm{e}^{imj\theta} \tag{2.1}$$

An example of the `gather` environment for equations is

$$\tilde{u}_1 \equiv v_j + \mathrm{i}w_j, \tag{2.2}$$

$$\tilde{u}_2 \equiv v_j - \mathrm{i}w_j. \tag{2.3}$$

An example of the `align` and `split` environments for equation formatting is

$$\begin{split} \tilde{\mathfrak{F}}_j \left[-(\mathbf{u}\cdot\nabla)\mathbf{u} \right]_r &= \mathfrak{F}_j \left[-(\mathbf{u}\cdot\nabla)\mathbf{u} \right]_r + \mathrm{i}\mathfrak{F}_j \left[-(\mathbf{u}\cdot\nabla)\mathbf{u} \right]_\theta \\ &= \mathfrak{F}_j \left[-\tilde{u}_1 \left(\frac{\partial u_j}{\partial z} + \frac{\partial v_j}{\partial r} + \frac{\mathrm{i}mjw_j}{r} \right) \right], \end{split} \tag{2.4}$$

$$\begin{split} \tilde{\mathfrak{F}}_j \left[-(\mathbf{u}\cdot\nabla)\mathbf{u} \right]_\theta &= \mathfrak{F}_j \left[-(\mathbf{u}\cdot\nabla)\mathbf{u} \right]_r - \mathrm{i}\mathfrak{F}_j \left[-(\mathbf{u}\cdot\nabla)\mathbf{u} \right]_\theta \\ &= \mathfrak{F}_j \left[-\tilde{u}_2 \left(\frac{\partial u_j}{\partial z} + \frac{\partial v_j}{\partial r} + \frac{\mathrm{i}mjw_j}{r} \right) \right]. \end{split} \tag{2.5}$$

Figure 2.1 illustrates drawing in LaTeX, which is hopelessly inefficient.

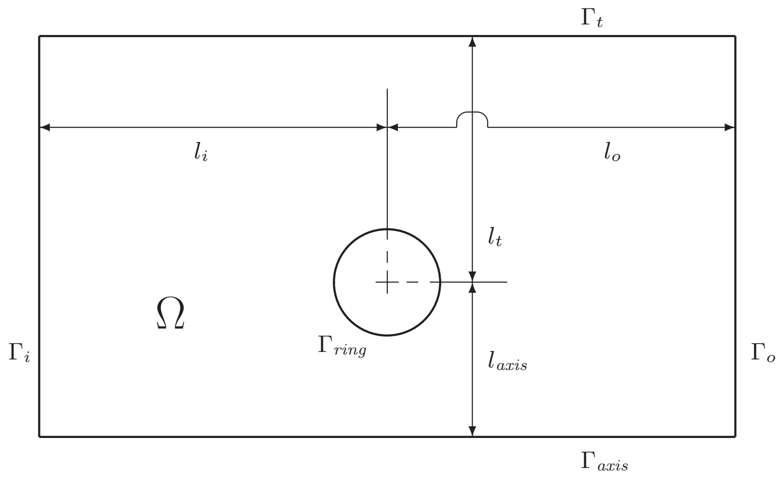

FIGURE 2.1: Diagram of computational domain Ω, with wall boundary and domain size nomenclature defined.

	Sphere studies		Circular cylinder studies			Square cylinder
	Mesh A	**Mesh B**	**Mesh C**	**Mesh D**	**Mesh E**	**Mesh F**
l_i	4.5	15	8	8	6	5.5
l_t	4.5	15	14	8	6	9
l_o	25	15	25	24	12	17.5

TABLE 2.1: Inlet, transverse and outlet computational domain lengths from numerical studies in the literature, normalised by the length scale, d. Sphere models include *Mesh A* from Tomboulides & Orszag (2000) and *Mesh B* from Johnson & Patel (1999), circular cylinder models include *Mesh C* from Barkley & Henderson (1996), *Mesh D* from Henderson (1997) and *Mesh E* from Zhang *et al.* (1995). *Mesh F* comes from a study of a square cross-section cylinder (Robichaux *et al.* 1999).

2.1.1.1 Tables and Figures

Table 2.1 is an example of a table in LaTeX.

Figure 2.2 illustrates a way of aligning a number of smaller component figures.

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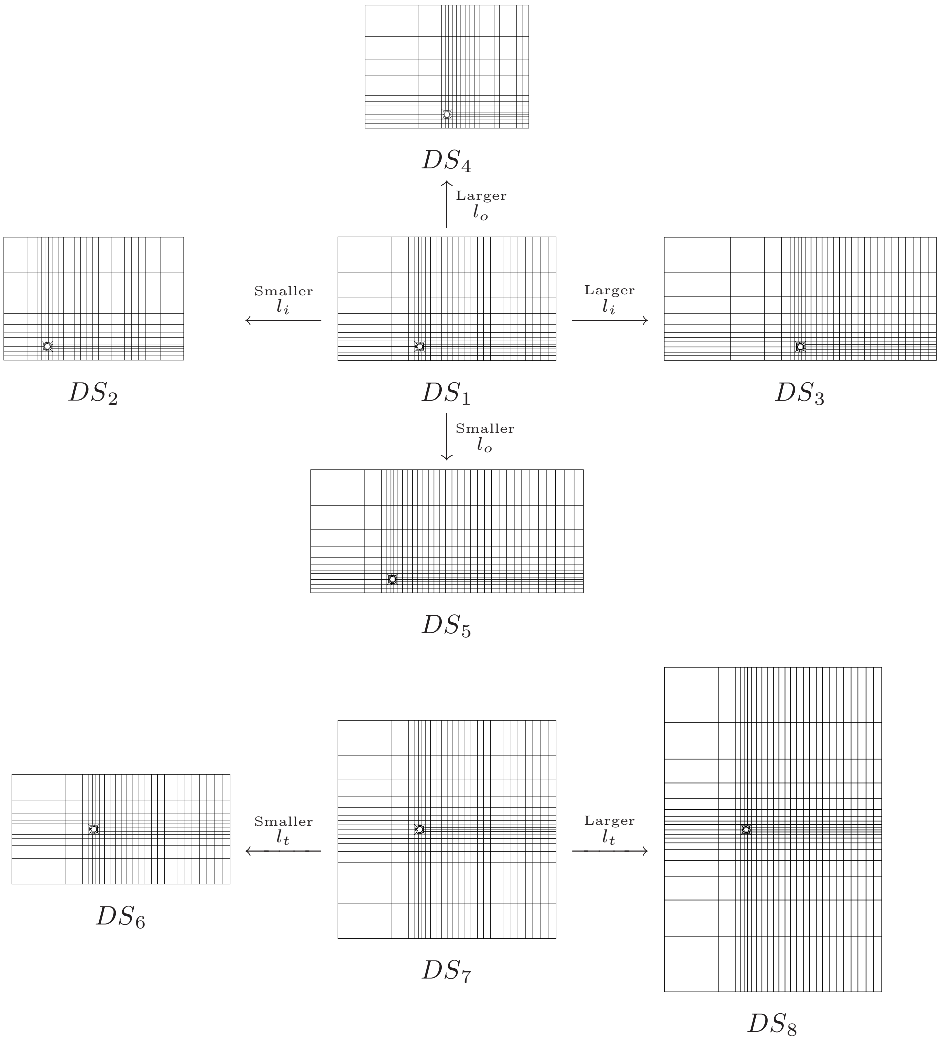

FIGURE 2.2: Groups of meshes used to test the effect of independently altering the parameters governing the domain lengths of the ring meshes. Note that meshes DS_1 to DS_5 define a ring with aspect ratio $Ar = 5$, for tests varying l_i and l_o. The meshes DS_6 to DS_8 define a straight circular cylinder to test the l_t length.

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Chapter 3

Another Chapter

More results and discussion.

Chapter 4

Yet Another Chapter

Even more results, etc...

Chapter 5

Conclusions

Conclusions go here.

5.1 A Section in the Conclusions Chapter

Text in a section of the Conclusions Chapter.

Bibliography

Balachandar, S., Mittal, R. & Najjar, F. M. 1997 Properties of the mean recirculation region in the wakes of two-dimensional bluff bodies. *J. Fluid Mech.* **351**, 167–199.

Barkley, D. & Henderson, R. D. 1996 Three-dimensional Floquet stability analysis of the wake of a circular cylinder. *J. Fluid Mech.* **322**, 215–241.

Fey, U., König, W. & Eckelmann, H. 1998 A new Strouhal–Reynolds-number relationship for the circular cylinder in the range $47 < Re < 2 \times 10^5$. *Phys. Fluids* **10** (7), 1547–1549.

Henderson, R. D. 1997 Non-linear dynamics and pattern formation in turbulent wake transition. *J. Fluid Mech.* **352**, 65–112.

Johnson, T. A. & Patel, V. C. 1999 Flow past a sphere up to a Reynolds number of 300. *J. Fluid Mech.* **378**, 19–70.

Robichaux, J., Balachandar, S. & Vanka, S. P. 1999 Three-dimensional Floquet instability of the wake of a square cylinder. *Phys. Fluids* **11** (3), 560–578.

Stokes, G. G. 1851 On the effect of the internal friction of fluids on the motion of pendulums. *Transactions of the Cambridge Philosophical Society* **IX**, 8.

Thompson, M. C., Leweke, T. & Provansal, M. 2001 Kinematics and dynamics of sphere wake transition. *J. Fluids Struct.* **15**, 575–585.

Tomboulides, A. G. & Orszag, S. A. 2000 Numerical investigation of transitional and weak turbulent flow past a sphere. *J. Fluid Mech.* **416**, 45–73.

Zhang, H.-Q., Fey, U., Noack, B. R., König, M. & Eckelmann, H. 1995 On the transition of the cylinder wake. *Phys. Fluids* **7** (4), 779–793.