

University of Stuttgart
Germany



[Thesis name]

Master's Thesis

[Your Name]
[Degree Program]

[Matriculation Number]

Examiner: [Name of examiner]

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Dept. of Hydraulic Engineering and Water Resources Management
Institute for Modelling Hydraulic and Environmental Systems (IWS)

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The main text, ideas, analyses, and conclusions presented in this thesis are entirely my own and were produced without the use of artificial intelligence (AI) tools for substantive or creative writing. AI-based language models (notably, **STATE TOOLS LIKE ChatGPT OR DeepL Write**) were used solely for spelling, grammar, and minor editorial refinements. These tools were not employed to generate content, develop arguments, produce code, or conduct research. I assume full responsibility for the originality, accuracy, and academic integrity of this work.

I consent to this thesis being made available for academic purposes in the libraries of the Institute for Modelling Hydraulic and Environmental Systems (IWS), University of Stuttgart, and to its publication in accordance with § 6 Abs. 1 UrhG (Urheberrechtsgesetz). Quotation of this work is permitted under § 51 UrhG.

Acknowledgments

add your Acknowledgments

Abstract

Abstracts should not be more than one page. A thesis written in Germany requires an additional English abstract.

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Notation

Roman letters

Letter	Unit	Description
g	m s^{-2}	gravitational acceleration
p	N m^{-2}	pressure
t	s	time, duration
u or $\mathbf{u}$	m s^{-1}	flow velocity
x	m	streamwise coordinate, pointing in the upstream direction
y	m	spanwise coordinate, pointing toward the right bank
z	m	vertical coordinate, pointing against gravity acceleration vector

Greek letters

Letter	Unit	Description
η	—	porosity
ν	$\text{m}^2 \text{s}^{-1}$	kinematic viscosity (Equation 2.2, page 5)
Φ	—	dimensionless bedload transport
ρ	kg m^{-3}	density of water

Acronyms, abbreviations, and subscripts

CFD	Computational Fluid Dynamics
GIS	Geographic Information System
GUI	Graphical User Interface
OS	Operating System

Note: SI unit abbreviations like "a" for annum or "m" for meter are not listed.

Chapter 1

Introduction

Welcome!

This template is provided at <https://github.com/Ecohydraulics/latex-thesis-template> and can be cloned with (requires [GitBash](#)):

```
git clone https://github.com/Ecohydraulics/latex-thesis-template
```

1.1 Background

Example reference to Figure 1.1, which is based on (Kim, 2017). If you need to introduce abbreviations like Operating System (OS), or parameters like the dimensionless bed load transport Φ , make sure to also define them at the beginning in `notations.tex`.

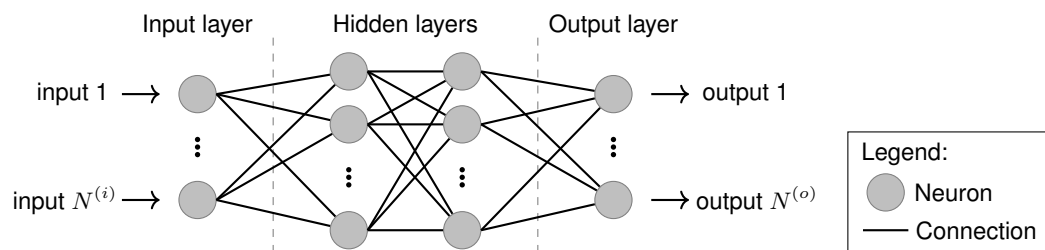


Figure 1.1: Structure of a neural network.

1.2 Motivation

Delineate the research gap (max. 2 pages).

1.3 Research question

Define a research question according to **FINER** criteria:

F – **feasibility** involves an adequate number of subjects, technical skills, affordability in the framework of this thesis, and manageable in scope

I – **interesting** questions are intriguing for the investigator (you) , peers (fellow students, supervisors), and the community

N – **novel** questions refute or extend the state of the art

E – **ethical** questions and methods adhere to moral standards

R – **relevant** questions are meaningful, that is, matter for the progress of scientific knowledge and constitute a basis for future research

Based on the research gap defined in section 1.2, define the hypothesis here:

Research question & hypotheses

What is needed because of the research gap (no Yes-or-No question)?

My test hypotheses are:

- (i) A specific aspect that can be boolean (True-or-False), which I test for answering the research question.
- (ii) Another specific aspect that can be boolean (True-or-False), which I test for answering the research question.

Chapter 2

State-of-the-Art

Check what others have done, which is relevant to your research question and to provide evidence for testing the hypotheses defined in section 1.3.

For coherence: note that chapter titles should be *Camel Cased*, while everything else is *Sentence cased*, including all kinds of section names.

2.1 Previous works

As explained in Negreiros et al. (2024). This statement can also be supported by multiple sources (Schwindt, Pasternack, Bratovich, Rabone, & Simodynes, 2019; Schwindt et al., 2023; Schwindt & Negreiros, 2023; Scolari, Fadul, & Schwindt, 2025).

2.2 Types of something and image manipulation

Do Kundu and Cohen (2008) talk about Lagrangian and Eulerian concepts visualized in Figure 2.1?

All figures and images should be stored in the `images` folder, so that in the `figure` environment, typing the image filename without the extension (JPG, PNG, etc.) in the `\includegraphics` command is sufficient.

Note that saving graphics in JPG format is usually the best option, and PNG is only useful for charts with low pixel coverage.

JPG is suitable for photographs and complex images where a smaller file size is important. It uses lossy compression, which reduces file size substantially. When using the JPG format for a thesis report, be sure to save at 300 dpi (dots per inch).

PNG is best used when you need lossless compression (heavy files!) and transparency support. It is ideal for charts with sharp edges, text, or areas of **solid** color, as it preserves detail without introducing compression artifacts.

GNU Image Manipulation Program, GIMP, is a powerful open-source image editing software suitable for a wide range of tasks, including photo retouching, image composition, and graphic design. It supports various file formats, including PNG and JPG, and provides advanced tools such as layer management, customizable brushes, and color correction features. GIMP is an excellent free alternative to commercial software, making it a great choice for students who ambition high-quality image editing capabilities without licensing costs.

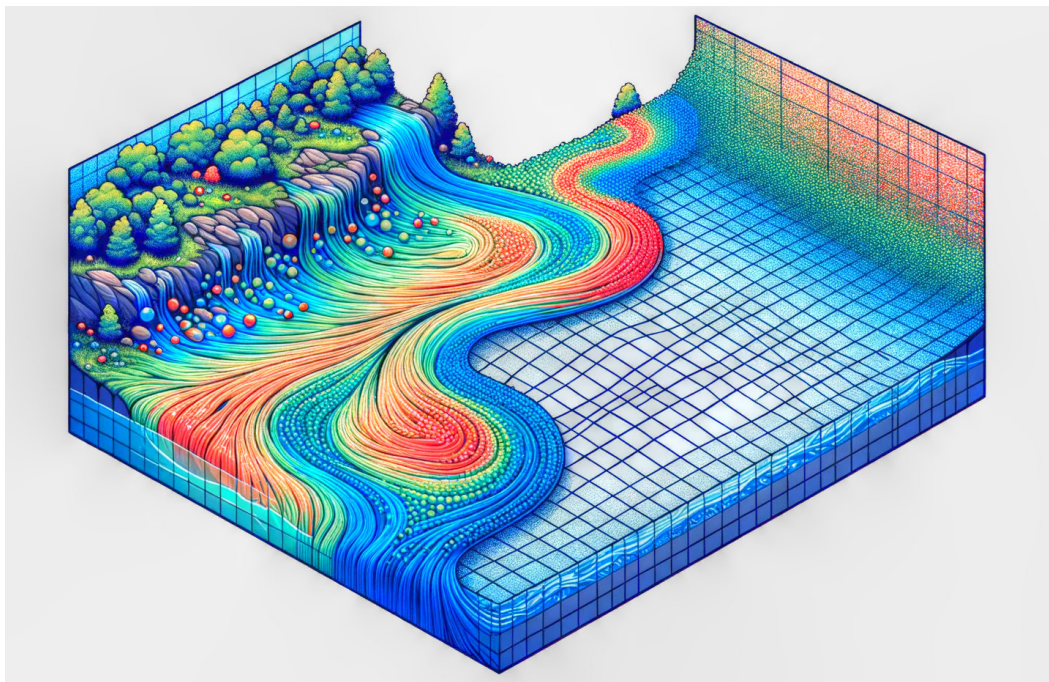


Figure 2.1: An example figure that visually tries to integrate Lagrangian and Eulerian concepts.

2.2.1 A subsection with table

As the Table 2.1 shows, this text has to introduce the thing before the table lists the use of the thing.

Table 2.1: Captions of tables should be positioned above the table, while figure captions should be in the bottom

Thing	Use
something	something
something	something
something	something

2.2.2 No subsection goes alone

And it should also have some text.

2.3 Something statistics with an equation

As shown in Equation 2.1

$$\text{happiness} = \frac{\text{EmptyCup} + \text{FavoriteDrink}}{\text{EmptyCups}} \quad (2.1)$$

2.4 A section header

2.4.1 The logic underlying something in a DEF BOX

Definition: The thing

This is the definition of the thing.

2.4.2 Concepts and terminology

Something set rules

Do not use `\subsubsection` levels. If needed, use `\subsubsection *` instead. This makes a difference in the table of contents.

2.5 Something or nothing?

Unnumbered non-sense header?

The note

Do you really need to do so much numbering?

2.6 Equations

Momentum conservation is described by the Navier-Stokes equation (Equation 2.2):

$$\rho \left[\frac{\partial \mathbf{u}}{\partial t} + (\mathbf{u} \cdot \nabla) \mathbf{u} \right] = -\nabla p + \rho \nu \nabla^2 \mathbf{u} + \rho \mathbf{g} \quad (2.2)$$

where t is time, $\mathbf{u}$ is flow velocity, ρ is fluid density, p is pressure, ν is kinematic viscosity, and $\mathbf{g}$ is gravitational acceleration. The viscous force term $\nu \nabla^2 \mathbf{u}$ is not part of the original Euler equations, which describe inviscid flow where viscosity is negligible. However, the simulation of fluid dynamics includes turbulence where viscosity, while often small compared to inertia and pressure forces, plays a critical role in conveying and dissipating kinetic energy (Macdonald, 2007; Kundu & Cohen, 2008).

Chapter 3

Methods

Describe the methods that **you** use to answer the research question. Remember: your goal is to provide a pathway for testing the hypotheses defined in section 1.3.

3.1 Algorithms

To explain your algorithms, use the boilerplate templates from our thesis class. For example:

```
1 def add_one(par):
2     """
3     :param int par: an integer input parameter
4
5     A simple function that adds one
6     """
7     return par += 1
```

Single commands or function_names can be written using the `\inlinecode` for general code, `python run_script.py` for shell commands, or `\inlinepy` for python_items.

3.2 Commands

Commands send to terminal can be written in a terminal environment, for instance, with guidance for cloning a repository:

```
git clone https://github.com/Ecohydraulics/latex-thesis-template
```

In-line, commands like `git clone` can be added.

However, for directories and filenames, use `/dir/to/code.py`.

Chapter 4

Results

Present your results here. This section should not include and reference (citation) because you are presenting your results. If you need a reference, the sentence you are about to write probably better fits into the state-of-the-art, methods, or discussion.

Remember: your goal is to provide evidence for testing the hypotheses defined in section 1.3.

Chapter 5

Discussion

Make sure to critically reflect on your results – a good discussion has at least five pages.

Describe logical links that can be inferred from your results here. How do the results help to test the hypotheses stated in section 1.3?

- **Do not** write: "The hypothesis is True" or "The hypothesis is False".
- **Do** write: "No evidence was found that the hypothesis is false." or "Evidence was found that the hypothesis is false."

Now, how does this help answering the research question; what remains uncertain; what are weaknesses in the methods? (This should be discussed here.)

Why so complicated?

From a scientific perspective, we can never be absolutely sure about the truth of a hypothesis. This is why we need to use this complicated writing.

Chapter 6

Conclusions

Not an abstract: summary of **new insights gained from this thesis based on the research question**, and as per the discussion.

- **Do not** mention out-of-the-Blue new information, not use math symbols or other abbreviations, and not summarize the introduction and motivation.
- **Do** extract the principal novelty here, which results from your own genuine work

Finally, open your compiled PDF file and search (CTRL or *strg* + F) for ??, that is, broken links and references.

References

- Kim, P. (2017). Neural network. In *MATLAB deep learning: With machine learning, neural networks and artificial intelligence* (pp. 19–51). Berkeley, CA: Apress. Retrieved from https://doi.org/10.1007/978-1-4842-2845-6_2 doi: 10.1007/978-1-4842-2845-6_2
- Kundu, PK., & Cohen, IM. (2008). *Fluid Mechanics* (4th ed.). San Diego, CA, USA: Elsevier Inc. Retrieved from <https://www.sciencedirect.com/book/9780124059351/fluid-mechanics>
- Macdonald, E. H. (2007, January). Metallurgical process and design (chapter 8). In E. H. Macdonald (Ed.), *Handbook of Gold Exploration and Evaluation* (pp. 488–552). Woodhead Publishing. Retrieved 2023-12-22, from <https://www.sciencedirect.com/science/article/pii/B9781845691752500088> doi: 10.1533/9781845692544.488
- Negreiros, B., Schwindt, S., Scolari, F., Barros, R., Galdos, A. A., Noack, M., ... Wieprecht, S. (2024, January). A database application framework toward data-driven vertical connectivity analysis of rivers. *Environmental Modelling & Software*, 172, 105916. Retrieved 2024-08-08, from <https://doi.org/10.1016/j.envsoft.2023.105916> doi: 10.1016/j.envsoft.2023.105916
- Schwindt, S., Callau Medrano, S., Mouris, K., Beckers, F., Haun, S., Nowak, W., ... Oladyshkin, S. (2023). Bayesian Calibration Points to Misconceptions in Three-Dimensional Hydrodynamic Reservoir Modeling. *Water Resources Research*, 59(3), e2022WR033660. Retrieved 2023-03-03, from <https://onlinelibrary.wiley.com/doi/abs/10.1029/2022WR033660> (e2022WR033660 2022WR033660) doi: 10.1029/2022WR033660
- Schwindt, S., & Negreiros, B. (2023). *Bedload Seasons*. Center for Open Science (OSF). Retrieved 2023-01-18, from <https://dx.doi.org/10.17605/OSF.IO/3ZMKN> doi: 10.17605/OSF.IO/3ZMKN
- Schwindt, S., Pasternack, G., Bratovich, P., Rabone, G., & Simodynes, D. (2019). Lifespan map creation enhances stream restoration design. *MethodsX*, 6, 756–759. Retrieved from <http://www.sciencedirect.com/science/article/pii/S2215016119300913> (S2215-0161(19)30091-3 S2215-0161(19)30091-3) doi: 10.1016/j.mex.2019.04.004
- Scolari, F., Fadul, M., & Schwindt, S. (2025, March). Hydro-morphodynamic numerical modeling indicates risk zones for riverbed clogging. *Scientific Reports*, 15(1), 10873. Retrieved 2025-04-02, from <https://www.nature.com/articles/s41598-025-95150-3> doi: 10.1038/s41598-025-95150-3

References

Appendices

References

Appendix A

Something to Complement

A.1 Maps, for example