CIMNE EXCELENCIA SEVERO OCHOA

# WINTER SCHOOL

*An excursion into computational methods*

January 24th – 28th, 2022

# Writing Communication

Narges Dialami

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# What makes good writing?

1. Good writing **communicates an idea clearly** and effectively
   - Good writing is elegant and stylish

1. Takes **having something to say and clear** thinking
   - Takes time, revision and a good editor

# What makes a good writer?

- Inborn talent?
- Years of English and humanities classes?
- An artistic nature?
- Divine inspiration?

- Having something to say.
- Logical thinking
- A few simple, learnable rules of style (the tools you will learn in this class)

**Good writing can be learned!**

# Writing is learned by writing

- Practice, practice, practice
- Choose good role models
- Study good examples
- But there are also techniques and rules to learn

# Objectives

- You can communicate in different forms
- Define the type of written document
  - Scientific articles
  - Research papers
  - Proposals
  - …

or

  - Books
  - Thesis
  - …

# Composition

IDEA ⇨ RESEARCH ⇨ PAPER

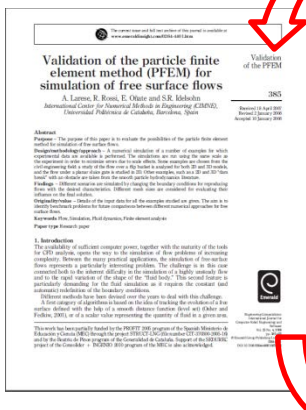
Validation of the particle finite element method (PFEM) for simulation of free surface flows

A. Larese, R. Rossi, E. Oñate and S.R. Idelsohn

*International Center for Numerical Methods in Engineering (CIMNE), Universidad Politécnica de Cataluña, Barcelona, Spain*

# Composition

IDEA ⇨ PAPER ⇔ RESEARCH ✓



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WHERE DO I START?!?!?!

# Title page

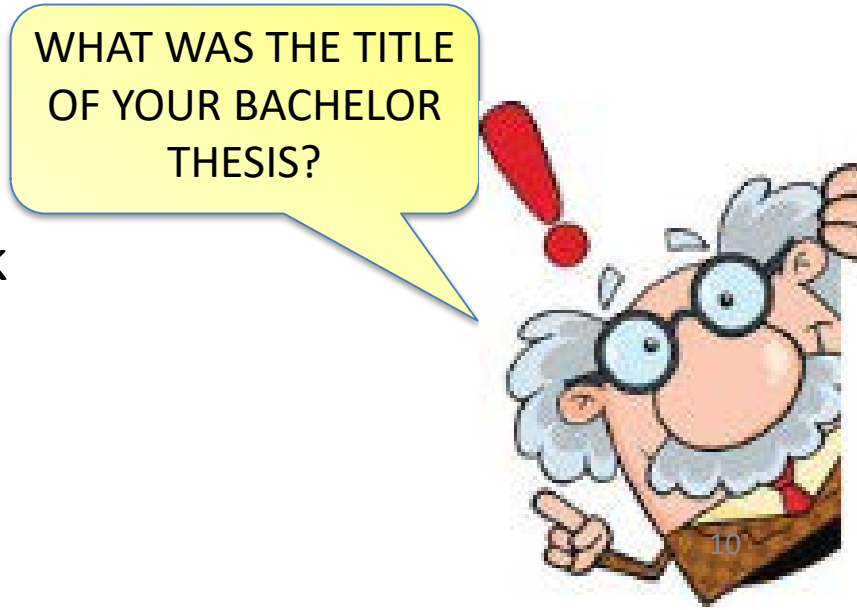
- The title page formally **announces** the title of the paper.

- The title page contains:

  - The article title
  - Author name(s)
  - Author affiliation

# Title, Authors, Keywords

- Use **descriptive words** that you would associate strongly with the content of your paper
- **Short** and unambiguous e, rarely a complete sentence
- It must contain the **key message** of your work
- It is **not an abstract**
- It should emphasize subjects or findings that are **unique to your study**.




Defined at the beginning of the work

BUT

Revised carefully at the end

# Title, Authors, Keywords

AUTHORS

- Decide your scientific name (“Xavier” or “Javier”?, “Gomez-Perez” or “Gomez”?)
- The simplest the best
- Avoid (if possible) accents and second surnames/names

KEYWORDS

- A majority of readers will find your paper via electronic database searches

# Five basic sections of a paper

1. Abstract
2. Introduction
3. Method
4. Results
5. Discussion

# The sections of a paper

| WORK FLOW | SECTION OF PAPER |
| --- | --- |
| What did I do in a nutshell? | Abstract |
| What is the problem? | Introduction |
| How did I solve the problem? | Methodology |
| What did I find out? | Results |
| What does it mean? | Discussion |
| Who helped me out? | Acknowledgments (optional) |
| Whose work did I refer to? | Literature Cited |
| Extra Information | Appendices (optional) |

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# The order of the sections of a paper

A. Title page
B. Abstract
C. Introduction
D. Method
E. Results
F. Discussion
G. Acknowledgment
H. References
I. Appendix

European Journal of Mechanics / A Solids 80 (2020) 103912

Contents lists available at ScienceDirect

European Journal of Mechanics / A Solids

journal homepage: http://www.elsevier.com/locate/ejmsol

## Defect formation and material flow in Friction Stir Welding

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ARTICLE INFO

*Keywords:*
FSW
Material flow
Defect formation
Computational modelling

ABSTRACT

This work addresses the issue of the simulation and prediction of defect formation through the analysis of the material mixing during Friction Stir Welding (FSW). A coupled thermomechanical model is used for the FSW simulation. To follow the flow of the material, a tracing technique of the material particles is incorporated in the numerical model.

A fast and accurate two-stage numerical strategy is adopted to analyse the FSW process. The speed-up stage intends to reach the steady state quickly. The material tracing is performed in the periodic stage where the rotation of the tool is modelled.

The effect of the process parameters and the pin features on the defect formation is studied. The model is capable of predicting defects such as void, wormhole, flash and joint line remnant, as well as the formation of "onion rings" in a single simulation. The results show that the proposed model has significant capability to explain and predict the post-FSW defects.

### 1. Introduction

Friction Stir Welding (FSW) is a solid state welding technology that has been widely used, due to the low defect and the lack of melting, in shipbuilding, trains, and aerospace industries since its invention (Thomas et al., 1991). Being a solid state joining technique, FSW precludes defects such as hot cracking and porosity. It is applied to join different types of alloys such as aluminium, stainless steel and magnesium which are hard to be welded using the traditional welding techniques.

FSW is a coupled thermomechanical process where the weld properties and the microstructure are affected by the heat and mass transfer (Zhang et al., 2018). Heat is generated by friction and plastic deformation. Higher heat input improves the material flow and mixing. High quality FSW joints are achieved by an appropriate material flow. As the microstructure evolution and mechanical properties of FSWeld alloys depend on the material flow in the joints.

The extent of the mass transfer and consequently, the joint quality made by FSW can be affected by many factors. Among them, the welding parameters such as advancing and rotating speeds (Kim et al., 2006; Ren et al., 2007) and the tool shape (Chen et al., 2018; Su et al., 2015; Yu et al., 2012) have a great influence on the material flow during FSW. Insufficient material flow during the welding process is the origin of the defect formation such as wormhole, tunnel defect, voids and joint line remnant (Morisada et al., 2015). These defects preclude the achievement of high strength joints as they influence the formation of the weld and affect the microstructure and hence the corresponding mechanical properties (Didžiokas et al., 2008). The cause of defect formation in FSW is one of the topics that requires further investigation.

Several types of defects may emerge due to an inappropriate combination of rotating and advancing velocities (Podržaj et al., 2015). Unsuitable choice of these velocities may cause insufficient or excessive heat input or abnormal stirring (Rasti, 2018). Wormholes and tunnel defects generally appear in the advancing side and are due to poor heat input and material flow (Arbegast et al., 2001). Kissing bond and joint line remnant defects occur at low rotating and high advancing speeds (Zhou et al., 2018). As a result of incomplete stirring action and poor heat input, the oxide layer breaks, reduces the flow of the plasticized material and forms the joint line remnant defect. High advancing speed induces void formation on the advancing side at the edge of the weld nugget (Zhang and Liu, 2012).

Material flow in FSW has been extensively studied experimentally to analyse the mechanisms of defect formation. Reynolds (2000) used a marker material method to characterize the material flow in aluminium alloy 2195 and to describe the physical behaviour of FSW using a qualitative representation of the material flow.

Hou et al. (2014) studied the influence of different T-joint geometries on the formation mechanism of the defects in FSW. Kissing bond and

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https://doi.org/10.1016/j.euromechsol.2019.103912
Received 20 May 2019; Received in revised form 15 October 2019; Accepted 21 November 2019
Available online 26 November 2019
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# ABSTRACT

# The sections of a paper: ABSTRACT

TO BE PREPARED AT **THE END**…

Let’s forget about it for the moment!

# INTRODUCTION

# The sections of a paper: INTRODUCTION

The goal of the introduction is to **justify** your study.

# The sections of a paper: INTRODUCTION

**CONTEXT**

- Introduce the **research question**
  - Present the physical/engineering problem in a general contest
- Discuss the **relevant research** literature on the topic (insert the proper citations)
  - Not just the studies whose results you agree with. Identify studies that support an **opposite finding**, and explain what might **underline the differences**.
- Summarize the **current understanding** of the problem you are investigating

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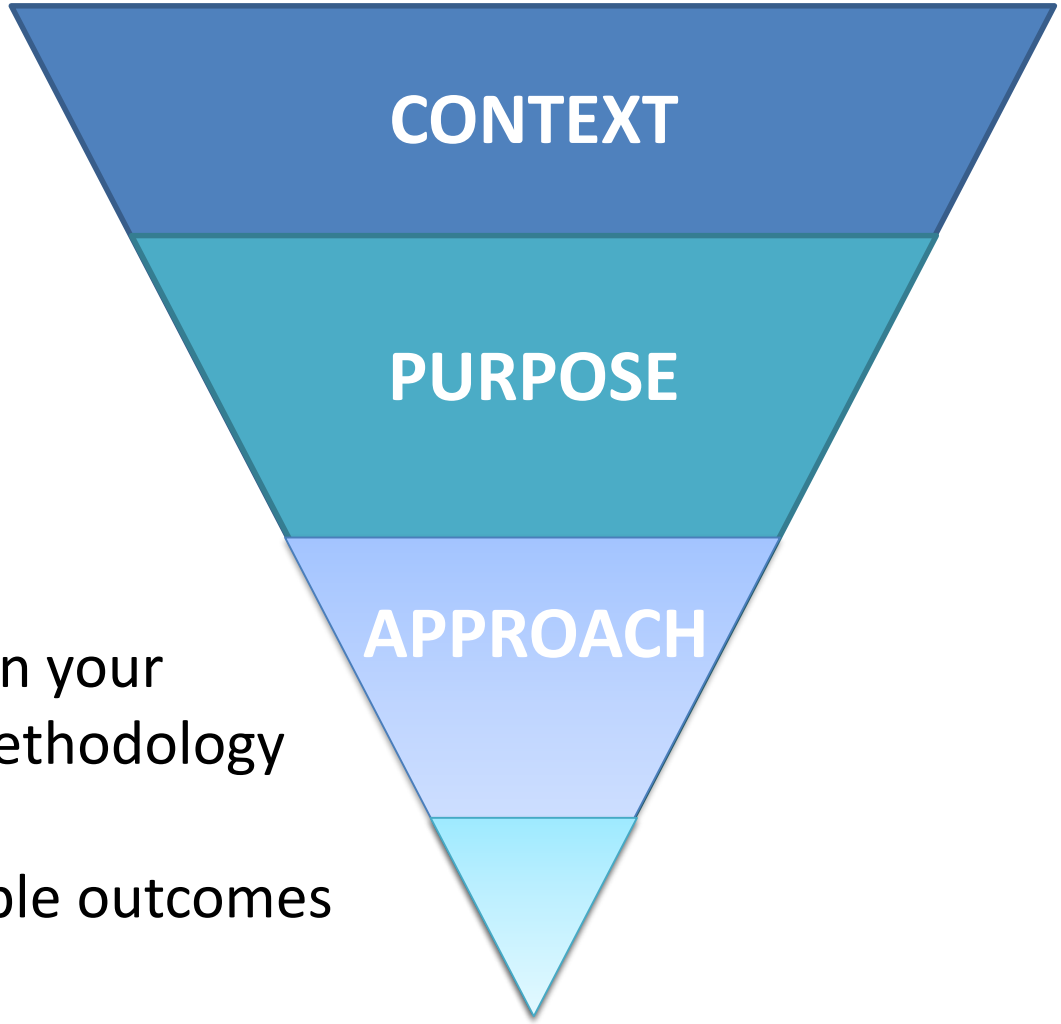
# The sections of a paper: INTRODUCTION

- Explain what work has yet to be done (your study)
- State the objectives of your work within the context
- Define your hypothesis, questions,…

# The sections of a paper: INTRODUCTION




- Briefly explain your approach, methodology
- Define possible outcomes

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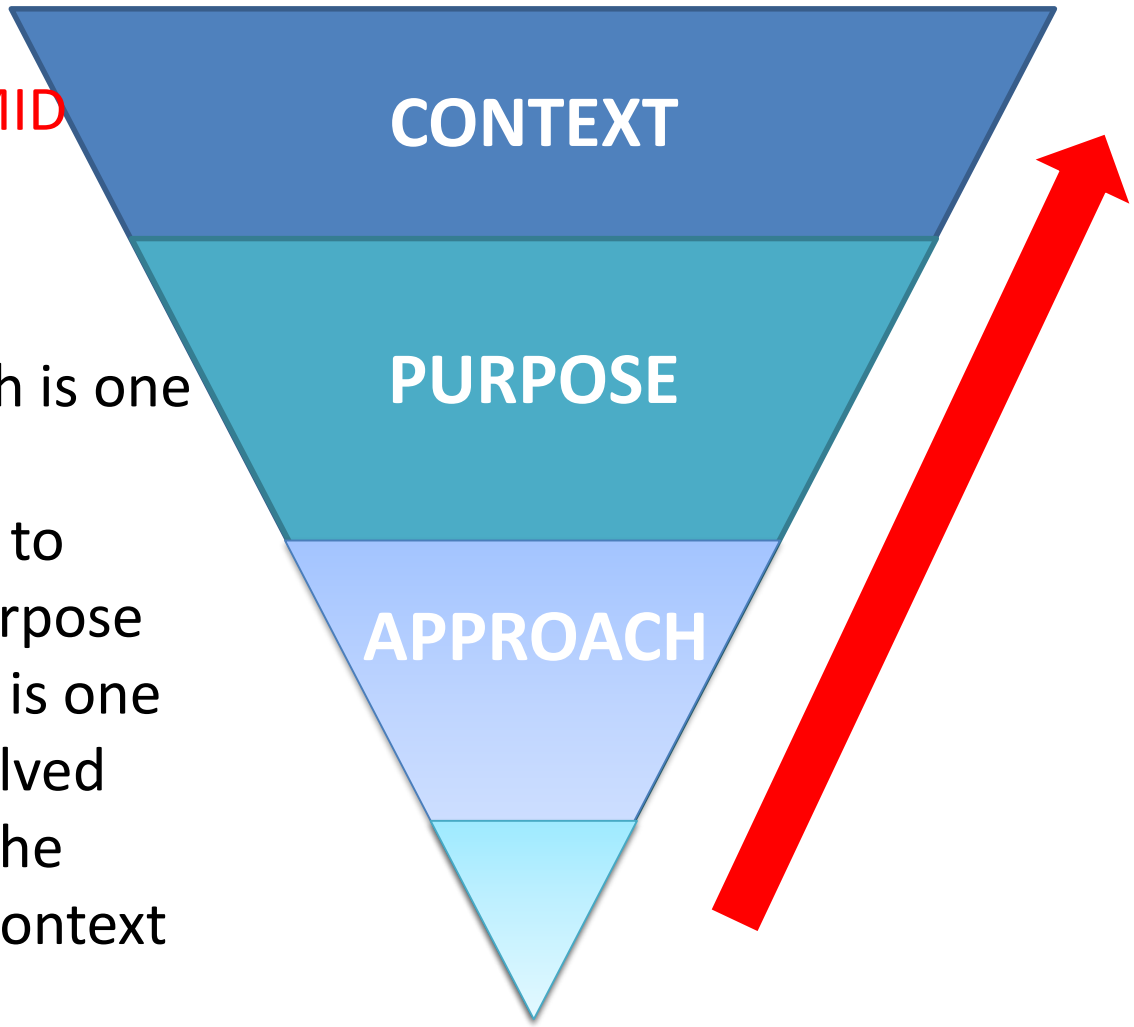
# The sections of a paper: INTRODUCTION

Structure of an Introduction
INVERSE PYRAMID

Conceive it the opposite way:

- Your approach is one possible methodology to solve your purpose
- Your purpose is one of the unresolved problems of the engineering context

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# The sections of a paper: INTRODUCTION

CITATIONS in the introduction are essential to:

- Know the literature you should look for to get a **comprehensive review** of the physical/engineering problem and on the methods used to solve it
- **Justify** your interest on the physical/engineering problem

*"(...) Overtopping is the main cause of failure of in rockfill dams [ICOLD Bullettin '99] (…)"*

- Help the reader understand **whom and how** solved the same or similar problems
  - Who else study the consequences of overtopping in rockfill dams experimentally? How?
  - Who did it numerically? How?
  - Under what aspects you will present an **innovation with respect to the SoA**?

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# The sections of a paper: INTRODUCTION

- Provide a clear statement of the RATIONALE for your approach to the problem studied.
  - How did you approach the problem?
  - Why did you chose this approach?
  - Do not discuss here the technique used.

- If you present an **innovative method**: the merits of the new technique/method versus the previously used *should be* presented in the Introduction.

# Introduction Section Outline Example

Broad Topic

## Background Information

- The subject of the study
- The impact of the subject of study
- More information about the subject of study

## Gap Analysis

- Previous works related to the subject of the study
- The limitations of the published works (or gaps)
- The importance of filling the research gaps for the field of study

## Research Goal/Hypothesis

- The goal of the study
- Why the study is the next logical step to fill the gaps in previous works
- Research hypothesis
- A summary of research method

## Results/the Significance of the Findings

- Research findings
- The significance of the findings
- The future impact of the study

Narrow Topic

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# Introduction sample

Deep brain stimulation (DBS) is a highly effective surgical therapy for helping people with movement disorders re-establish control over their motor function. Much of its success has been based on long-term experiences with surgical ablation for managing hyperkinetic and hypokinetic states.[1] These procedures not only provided the impetus to develop a stereotactic apparatus for targeting deep brain structures,[2,3] but they also imparted critical knowledge of what brain regions are involved in the expression of motor signs for various movement disorders.[4,5] Intraoperative electrical stimulation was recognized early on as an important pre-lesion targeting tool, capable of augmenting or suppressing motor signs depending on the frequency and amplitude of stimulation. In 1960, Hassler et al.[6] reported that low frequency stimulation (LFS, <25 Hz) in the globus pallidus elicited contralateral tremor in parkinsonian patients, whereas high frequency stimulation (HFS, 25–100 Hz) applied to the same location suppressed tremor. Since then, similar stimulation-dependent effects have been reported in other nuclei and for other clinical indications (Fig. 1). DBS offers important advantages over the immutable effects of ablative procedures, including the reversibility of the surgical outcome and the ability to adjust stimulation parameters post-operatively to optimize therapeutic benefit for the patient while minimizing adverse side effects.[7,8] Thousands of DBS implants are now performed each year for a growing number of movement disorders.[9–11] However, despite the clinical successes of DBS, we still lack a fully formulated theory for how DBS works.[12–14]

Topic

Significance

Background

Gap

# Introduction sample

1. Introduction

Caring for patients in the medical intensive care unit (MICU) requires residents to perform several essential competencies. In a time-sensitive, emotionally, and physically stressful environment, MICU residents are expected to manage medically complex and acutely ill patients. Residents must also acquire knowledge regarding management of complex critical illness. Exposure to critical care medicine varies widely among medical schools in the United States, and little is known about the preparation of first-year residents to provide MICU care. Anecdotal evidence from critical care faculty at our own institution indicates that first year resident preparation varies widely, and knowledge gaps often exist. This is confirmed from findings of a survey study of resident physicians that many do not have adequate evidence-based knowledge about how to manage patients receiving mechanical ventilation [1]. Residents also expressed dissatisfaction with their training in critical care medicine and mechanical ventilation [1].

**Topic** → MICU, patient care, and residents

**Significance** → practical, clinical

**Lit Review** → focusing on MICU, patient care, and residents training

High-fidelity patient simulators are being used with increasing frequency to train health care providers in safe, controlled environments. The use of simulation technology has the potential to shape medical education and the quality of care that residents provide [2]. The American Board of Internal Medicine (ABIM) recommends that internal medicine residents receive simulator training before performing invasive procedures on patients [3]. Previous studies of simulation-based education have established its effectiveness to improve skills and reduce costs in areas such as laparoscopic surgery [4-6], endoscopy [7], advanced cardiac life support (ACLS) [8-10], emergency airway management [11], trauma resuscitation [12,13], bronchoscopy [14], obstetric emergencies [15,16], and central venous catheter insertion [17-19].

**Lit Review** → simulators

Despite widespread use of simulation, little is known about the effectiveness of simulator training as a method of preparing residents for clinical rotations, such as the MICU. Stanford University investigators developed a scoring system to evaluate management of septic shock using patient simulators and were able to differentiate the quality of resident performance in simulated scenarios [20]. In another study, medical students performed better during a simulated scenario of dyspnea if they received simulator training rather than problem-based learning [21]. However, neither study determined if simulation-based education transferred into improved clinical care.

**Gap** → motivation for study!

**Lit review** → focus on gap

The aim of this study was to determine the effect of simulation-based education on the knowledge and skills of first-year internal medicine residents managing critically ill patients receiving ventilator support in the MICU. We hypothesized that a simulation-based educational intervention would boost resident knowledge and skill as assessed by a bedside skills assessment checklist.

**RQ/RS** → includes hypothesis

**Use of simulation-based education to improve resident learning and patient care in the medical intensive care unit: A randomized trial.** http://www.ncbi.nlm.nih.gov/pubmed/22033049

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# METHODOLOGY

# The sections of a paper: METHODOLOGY

- The method section is the **detailed** breakdown of your work
- Give the reader **enough information** to be able  replicate the work
- The method section is often divided into **subsections**

# The sections of a paper: METHODOLOGY

- In this section you explain *clearly* HOW you carried out your study

- Describe your numerical method/novel technique/numerical approach clearly

DID YOU PROVIDE SUFFICIENT DETAILS SO TO ALLOW THE READERS TO PROGRAM YOUR NOVEL ALGORITHM?

# The sections of a paper: METHODOLOGY

- Do not tell everything
- Concentrate on your contribution with respect to the SoA

BUT

- make the story readable!

- Do not put one equation after the other with no explanation!

  - *Governing equation in strong form*
  - *Weak form of the problem*
  - *Time and space discretization*
  - *Other aspects (stabilization, kinematical description, …)*

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# RESULTS

# The sections of a paper: RESULTS

Is your computational model solving the mathematical model?

VERIFICATION & VALIDATION

Is your computational model solving the engineering problem?

# The sections of a paper: RESULTS

- The examples should be chosen to DEMONSTRATE that you achieved your objectives
- Remember to be OBJECTIVE
- There may be some qualitative results but you need to present QUANTITATIVE results
- Use visual aid (images, graphs) and self explained captions
- DISCUSS your results

# The sections of a paper: RESULTS

- Provide **all the necessary data to reproduce** your models
  - Geometrical data
  - Boundary conditions
  - Initial conditions
  - Materials properties
  - ….

- Always report the appropriate UNITS

# CONCLUSIONS

# The sections of a paper: CONCLUSIONS

Provide a short, schematic summary of what you have presented in the paper and answer these questions:

- Do your results provide **answers** to your testable **hypotheses**? If so, how do you interpret your findings?
- Do your findings **agree with** what **others** have shown? If not, do they suggest an alternative explanation or perhaps an unforeseen design flaw in your model/technique (or theirs?)
- Given your conclusions, what is our **new understanding** of the problem you investigated and outlined in the Introduction?
- If warranted, what would be the **next step** in your study, e.g., what experiments would you do next?

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# The sections of a paper: CONCLUSIONS

- In this section, **interpret** your results by **relating** them to your hypotheses.
- Discuss the results **in relation** to each hypothesis.
- Discuss possible **explanations** for your results.
- Identify and discuss **limitations** of the study.
- **Generalize** your results.

# AKNOWLEDGEMENTS

# The sections of a paper: ACKNOWLEDGEMENTS

- Remember to acknowledge the people who participate to the work you are presenting but are not present among the authors.
- Remember to acknowledge the financing institution/agency
  - Personal scholarship

    *"Mr XXX gratefully acknowledges the support of the Spanish Ministerio de Educación through a doctoral grant in the FPU program. "*
  - Funding project (with all the details)

    *"The research was supported by the Spanish Ministry of Economy and Competitiveness (Ministerio de Economía y Competitividad, MINECO) through the project EACY (MAT2013-48624-C2-1-P)."*

    *"The financial support of the T-MAPPP project (FP7 PEOPLE 2013 ITN-G.A.n607453) is greatly acknowledged."*
  - Other financing entity

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# REFERENCES

# The sections of a paper: REFERENCES

- Must contain complete citations for all sources mentioned in the paper
- Use the specified journal format
  - **CMAME** S.Z. Feng, X. Han, Z.J. Ma, G. Królczyk, Z.X. Li, Data-driven algorithm for real-time fatigue life prediction of structures with stochastic parameters, Comput. Methods Appl. Mech. Engrg. 372 (2020) 113373.
  - **Comp. Phys**. Liang Hu, Mingbo Li, Wenyu Chen, Haibo Xie, Xin Fu, Bubbling behaviors induced by gas-liquid mixture permeating through a porous medium, Phys. Fluids 28 (8) (2016) 087102.
  - **Friction** Archard J. Contact and rubbing of flat surfaces. J Appl Phys **24**(8): 981–988 (1953)

# APPENDICES

# The sections of a paper: APPENDICES

- An Appendix contains information that is **non-essential** to understanding of the paper

- It may present information that further clarifies a point without burdening the body of the presentation.

- An appendix is an *optional* part of the paper, and is only **rarely found in published papers.** Quite common in Thesis and books

# ABSTRACT

# The sections of a paper: ABSTRACT

- The abstract is the **Reader's Digest** version of the paper
  - Its purpose is to show the reader the research **at a glance**
- Condensed format
  - Abstracts must be condensed yet **stand alone**. The abstract should be **understandable** for some one who has not read the paper.
- Order
  - Each section of the paper requires 1 to 2 sentence in the abstract. Information is arranged in the **same order** as the sections in the paper: introduction, method, results and discussion
- Single paragraph
  - Abstracts should be presented in **one paragraph**.

# The sections of a paper: ABSTRACT

An abstract **summarizes, in one paragraph (usually), the major aspects of the entire paper** in the following prescribed sequence:

1. the QUESTION(S) you investigated (or purpose), (from Introduction)
2. the experimental design and/or METHODS USED, (from Methods)
3. the MAJOR FINDINGS including key quantitative results, or trends (from Results)
4. a brief summary of your interpretations and CONCLUSIONS. (from Discussion)

# The sections of a paper: ABSTRACT

- Length approx. 200-300 words
- Style:
  - The abstract is only TEXT
  - Manly passive form used
  - Use past tense
- NOT ALLOWED
  - Images, tables, illustrations
  - References
  - Abbreviations

# The sections of a paper: ABSTRACT

- It has to be “attractive”:

the reader will decide weather to read or not your paper depending on the abstract

# The sections of a paper: ABSTRACT

IF YOUR ABSTRACT WAS THE ONLY PART OF THE PAPER YOU COULD ACCESS, WOULD YOU BE HAPPY WITH THE INFORMATION PRESENTED THERE?

# Abstract sample

**Abstract Title:** Coevolution-Based Inference of Amino Acid Interactions Underlying Protein Function

Protein function arises from a poorly understood pattern of energetic interactions between amino acid residues. Sequence-based strategies for deducing this pattern have been proposed, but lack of benchmark data has limited experimental verification. Here, we extend deep-mutation technologies to enable measurement of many thousands of pairwise amino acid couplings in several homologs of a protein family - a deep coupling scan (DCS). The data show that cooperative interactions between residues are loaded in a sparse, evolutionarily conserved, spatially contiguous network of amino acids. The pattern of amino acid coupling is quantitatively captured in the coevolution of amino acid positions, especially as indicated by the statistical coupling analysis (SCA), providing experimental confirmation of the key tenets of this method. This work exposes the collective nature of physical constraints on protein function and clarifies its link with sequence analysis, enabling a general practical approach for understanding the structural basis for protein function.

**KEY**

Abstract contains sufficient background to understand the problem under investigation

Abstract must contain a hypothesis, objective or statement about the problem under investigation

Abstract must contain a brief statement of the experimental methods/methodology used

Essential results must be present in summary form (even if preliminary)

Abstract must contain a conclusion that explains how the work contributes to the hypothesis, objective or statement of problem

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# The hourglass method

- **Introduction**
  - Starts out very **broad**, ends up **narrowly** focusing on your specific study and its hypotheses
- **Method**
  - Very **narrow**, detailed, technical and specific
- **Results**
  - Still **narrowly** focused on the **specific results** of the specific work you performed to test your hypotheses.
- **Discussion**
  - Starts out very **narrow**, summarizing your results; then becomes **broader** as you discuss the implications and limitations to your research; ends up **broadly** conveying the 2-4 most important things you want your readers to remember from your research

# Other tips

# Style

Fonts:

- avoid Arial and sans-serif fonts. They are good for presentations and posters but are harder to read in continuous text.
- Use fonts from the Time New romans family or similar serif fonts instead
- Unusual fonts are less likely to be available at the recipient and may cause printing or display problems

**Serif**

Times New Roman
abcdefghijklmnopqr
stuvwxyz1234567890

Garamond
abcdefghijklmnopqr
stuvwxyz1234567890

Courier
abcdefghijklmnopqr
stuvwxyz1234567890

**Sans Serif**

Arial
abcdefghijklmnopqr
stuwxyz1234567890

Arial Narrow
abcdefghijklmnopqr
stuwxyz1234567890

Comic Sans
abcdefghijklmnopqr
stuwxyz1234567890

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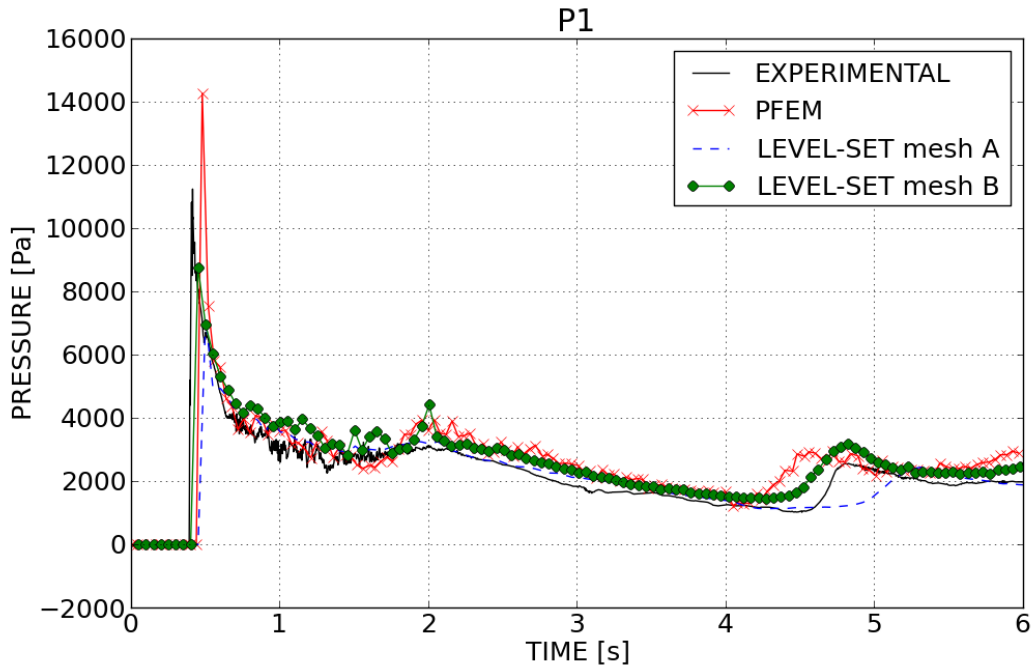
# Images/Figures/Graphs

- Black & White or colored figures/graphs?




When creating a graph/image, **use colors**, but conceive it to be readable if printed in **black and white**

# Images/Figures/Graphs

- USE IMAGES, they are extremely helpful
- The reader is lazy: the images are the only thing, together with the abstract and conclusions, that will be read for sure
- Be careful when writing the caption.

Good tools:

- INKSCAPE (easy, good tutorials, free, available for Linux and windows)
- Other tools: Photoshop, GIMP, Corel draw, Autocad, …

# References

Jean-Luc Doumont et al., *English Communication for Scientists,* in Scitable
http://www.nature.com/scitable/ebooks/englishcommunication-for-scientists-14053993

• Michael Alley, *The Craft of Scientific Writing* and *The Craft of Scientific Presentations.*
http://writing.engr.psu.edu
• The Mayfield Handbook of Technical and Scientific Writing
http://www.mhhe.com/mayfieldpub/tsw/

• Nicholas J. Higham, *Handbook of Writing for the Mathematical Sciences*, Second Edition, SIAM, 1998 http://www.maths.manchester.ac.uk/~higham/hwms/

http://abacus.bates.edu/~ganderso/biology/resources/writing/HTWsections.html