OPENING REMARKS FOR RESEARCH TOOLS

1. Opening remarks

What employers want

- Ability to communicate both written and orally
- Ability to teach yourself, you can find the information which is needed
- Educated
- Personality fit

Tools to conduct research

- Math
- Library

Means to communicate your investigation

- Written manuscript: Thesis (Grammer, Word Processor, Graphics)
- Oral: (Powerpoint, Beamer)
- Poster: (Powerpoint, PDF)

The divisions of mathematics

- Pure Mathematics aims to rigorously prove what is under investigation
- Middle: Derivation of Mathematical Methods
- Applied Mathematics formalize, analyze and solve mathematical models

2. Thesis Layout

- Abstract
- I: Introduction
- II: Formulation of the model or governing equations
- III: Analysis of governing equations
- IV: Solution of the problem
- V: Presentation and discussion of your results
- VI: Summary, conclusion, and future work

2.1. **Abstract.** A paragraph in length.

- Topic
- Question
- Approach
- Results

2.2. I: Introduction.

- What is the topic under investigation?
- What question(s) am I trying to answer? Hypothesis
- Why is this question important?
- LITERATURE REVIEW (30 papers, $4-5$ pages in length)
  - What has tried to answer this question?
  - What means were used to answer the question?
  - What significant or relevant findings resulted from these works?
  - What are the limitations (assumptions) of these previous investigations?
- What is my approach?
- What is innovative or unique about my approach?
- What are the significant results I have obtained?
- What are the limitations of my results?
- What should I do next?

2.3. II: Formulation of the model or governing equations.

- Figure describing the "domain" of the problem
- List our governing equations and describe the meaning of the equation and of each term of the equation
- The moment you introduce a new variable define it. You may use a table.
- List boundary and initial condition and their meaning

2.4. III: Analysis of governing equations.

- Define the scales for each dependent and independent variable and establish a non-dimensionalization scheme
- List the non-dimensional problem
- Define your assumptions and justify them
- List the "ultimate" problem you will now solve

2.5. IV: Solution of the problem.

- Outline the steps of the solution procedure and then carry out the steps
- Present "all" details of the solution process

2.6. V: Presentation and discussion of your results.

- Every figure and caption should stand alone from the text
- A reader must be able to determine the meaning of the figure without reading the text and reproduce the figure from the given batch of data

2.7. VI: Conclusions.

- Topic and question
- Approach
- Results, "Why question is important"
- Limitations of results
- What should I do next