2.672 Project Laboratory
Spring 2009

SECTION 3: A GUIDE TO 2.672 LAB REPORT WRITING

ELEMENTS OF A LABORATORY REPORT

1. Title page
2. Abstract
3. Table of Contents*
4. List of Symbols*
5. Introduction
6. Theoretical Analysis
7. Apparatus and Procedure
8. Results and discussion

10. Conclusions (and Recommendations)
11. Appendices*
12. References

*Optional

Individual reporting
You can share ideas, data and results with your group members. You need, however, to write your own project report.

Focus on your contribution
You should focus on your ***contributions*** to the understanding and solution of your project problem. You developed a model to characterize the problem. It is a ***remarkable*** achievement. Although your model may not be perfect, it is an important tool to understand the essential physical processes. Write your report to help people understand and solve real-world engineering problems. Do not write the report focusing on how inaccurate your model is.

Writing style
In general, do not use "I" , "we", "he", or "she" in technical writing. Here are some examples.

Example 1. "This work developed an engineering model to assess wafer temperature in hot-plate photoresist processing."
Example 2. "The experimental system consists of three major parts."

Write directly, avoid words that are not useful; e.g. "in order to", "the purpose of this experiment is to", etc.

Number of significant digits
If you report a temperature of 100.002 C, it suggests that the temperature error is less than 0.001 C. You should present your results with the right number of significant digits to represent the accuracy of your experiments and model simulations.

TITLE PAGE

Title must include key words about the project and reveal the topic of the report. Title page should include:

- Author's Name
- Project Supervisor
- Names of Group Members
- Section Number
- Date

ABSTRACT

The abstract is a brief (approx. 150 words) condensation of the report. ***Do not explain why the study is done in the abstract.*** That belongs to the introduction. Describe each of the following in one or two sentences.

- What was done
- How it was done
- Significant results

INTRODUCTION

- State context/background of study
- Articulate the need for the study
- Clearly define the problem (purpose of the investigation)
- Outline overall approach

THEORETICAL ANALYSIS

Physical explanation of phenomena

It is important to point out the pertinent physics governing the phenomena that you are studying. It helps to orient the readers, and give context to your theory and experiment.

Develop governing equations

- Assumptions: support the them quantitatively, e.g., assume laminar flow - give Reynolds number.
- Describe the model development; give the major equations, but leave detailed algebra to the appendix. This part should be written as a mixture of equations and sentences and not just a list of equations.

Computer Simulation

- Connect your equations to the numerical scheme used; specify the initial and boundary conditions
- Discuss numerical parameters (e.g., step size in integrating differential equations);
- Do not put program listing in text; put it in an appendix

APPARATUS AND PROCEDURE

Overview of Operation

- Refer to the schematic and explain the overall operation.
- Give dimensions of the apparatus. Point out the relationship between the laboratory device and the actual device.
- State what are being measured. Give detailed information of the transducers and measurement systems only if they are uncommon devices.
- Give accuracy and frequency response of the transducers. (Also give sampling rate and total sampling duration if you use an A/D system.)
- Discuss the calibration procedure very briefly; details should be in the appendix, not in the main text.

Conduct of the Experiment

- Brief description of the experimental procedure.

- List sets of experiments done.
- Give range of parameters that you have varied.

RESULTS AND DISCUSSIONS

Organize your results and discussions in coherent pieces so that the observed phenomena can be connected to your explanations and simulations.

- Present the results by referring to the figures. (Figures are much better than tables.)
- Describe the direct observation first (e.g., pressure as a function of time) - ***point out and explain the features in the observation in terms of physical laws***.
- Describe how the results change when you vary the parameters of the experiment.
  - > magnitude of change (goes up/down, by how much)
  - > scaling (e.g., peak pressure proportional to the driving pressure, etc.).
- If appropriate, point out what is the most sensitive parameter?

Discussions

- Compare Theoretical Results with Experiment
- See if theoretical results produce the same features as the direct observations of the experiment (e.g., pressure versus time curve).
- Compare quali/quantitatively the theoretical predictions and the experimental values when the experimental parameters are changed.
- Plot theoretical curve on the same graph as the experimental points.
- Account for and Explain Discrepancy
- Discuss assumptions/idealizations used in the development of the model and how they effect the theoretical predictions (e.g., do they result in an overestimate or an underestimate?)
- Do not blame the discrepancy on instrumentation. If you knew the instrumentation was inadequate, you should not have wasted your time in making the measurement in the first place.
- -. Present model applications and engineering design if required.

CONCLUSIONS

- Brief summary of your finding
- Pronounce your judgment here
  - What are the key parameters of the experiment?
  - How good is your model?
  - Does it give upper/lower bound of the results?
- Implications of your conclusions: how your results would apply to your original objective
- If applicable, present recommendations for what further work is needed (optional).

APPENDICES

Appendices are for details that your reader may need in order to replicate your work, but they are not required to understand your work. Essential derivations, governing equations, key assumptions and definitions **DO NOT** belong in the Appendices; they belong to the main text. Details of calibrations and procedures **DO** belong in Appendices.

The appendix section, however, has often been misused in 2.672 as a “dumping” area for equations and data tables. That is not appropriate. There should be text description on the equations and tables.

FIGURES AND GRAPHS

Refer to figures to explain procedures and theory. Graphs are much more informative than data tables because trends can be identified much more easily.

Figures and graphs should be labeled well enough to allow them to stand alone as documents.

- The physical apparatus for the experiment ***should be drawn as a schematic and not as a three-dimensional drawing.***
- Results should be presented in graphical form whenever possible.
- All figures and graphs should be referred to in text before their appearance. They should all be numbered.

Graphs

1. Title should be short but informative. It should include what is being graphed and any additional information needed to interpret the graph.
2. Axes should be labeled (for quantities with dimensions, units are required).
3. Use symbols for data points and lines for theoretical predictions.
4. Each curve should be marked clearly and distinctly.