Project Guidelines  
ME 8243: Advanced Fluid Power

The topics in this course will be put to practice in an open-ended project in the field of fluid power component or system design. Projects will be carried out in teams of 2-4 students on a topic of your choice to meet the need of some real-world application. It is expected that teams will use steady-state and dynamic models to predict the system performance and inform the design. Your project will be evaluated through a project proposal, progress reports, oral presentation, and a final report. The final report will be in the format of an ASME journal or conference paper. Some teams may wish to submit their work to a conference, such as the ASME Fluid Power and Motion Control Symposium, which has an abstract deadline of February 5, 2019.

This document summarizes the project expectations. The critical due dates are summarized in Section 1. The modeling and design approach are presented in Section 2. Section 3 contains guidelines for the deliverables.

1. Due Dates (5pm on date listed):

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Please submit all written documents to me in PDF format via e-mail: vandeven@umn.edu.

2. Modeling and Design Process: A recommended framework for your project includes:
   1. Define the component or system you are designing. Draw the hydraulic circuit diagram and any appropriate circuit diagrams. Use these figures to define variables.
   2. Roughly size the parameters in your component and/or system. Steady-state models are often useful for this step.
   3. Develop equations that describe the dynamic behavior of the system.
   4. Create models from your system of equations to predict dynamic performance and metrics that are important to your application (efficiency, power density, control bandwidth, control precision, etc.).
   5. Use your model to improve the design of the component or system. This will likely include some form of an optimization or grid search. This is also a good opportunity to explore parameter sensitivity.
   6. Document your proposed system, your dynamic model, the design process, and the obtained results.

3. Deliverables:
   Project Proposal: Your project proposal is a 1-2 page document that will include:
a) Background & Introduction: Briefly describe the motivation for your project and what you are proposing for a project topic.
b) Method: Describe the modeling, analysis, and design procedures you expect to utilize in the project.
c) Figure(s): Include at least one figure or sketch that describes the problem. This could be the circuit diagram of a system, the cross-sectional view of a component, or other illustration of the problem.
d) Schedule: When will you accomplish the various aspects of your project? This will help you determine is if the scope of the project is reasonable.

If your project is related to the work, research, or thesis of somebody on your team, clearly explain that relationship.

The proposals will be reviewed and returned to you with comments. I may suggest an adjustment to the topic, a change in the scope, or, occasionally, a complete change of topic. Please understand that does not mean that your initial idea was poor; rather, it only means I am concerned alignment with the course goals or being of appropriate scope. You may be asked to address any concerns and resubmit your project proposal.

Progress Report: Part way through the project, your team will write a concise progress report. The progress report will provide an opportunity for me to provide feedback on your project and document your work to date. In addition to providing an update of the work completed, include a revision of your schedule that documents what you will complete through the remainder of the project. In your progress report, you are encouraged to include pictures, circuit diagrams, graphs, figures, screenshots, or tables as appropriate. Try to view the progress report as an extension of your laboratory notebook, summing up your work to date. The progress report should be written in a memo style, with a maximum of four pages of text. Additional pages are allowed for figures and tables.

Final Paper: The format for your final paper is similar to a journal paper with the exception that your paper will include additional details that cannot be included in a journal paper due to length constraints.

General Guidelines
- Times New Roman 11 or 12 pt. font
- 1.5 spacing (Abstract may be single spaced)
- Single column
- 30 page limit, including figures and any appendices
- All units of measure should be in the SI system. If the U.S. customary units provide meaning, include them in parenthesis.
- Assume that the audience for your paper is well-educated with some fluid power experience.
- Develop any necessary equations in the body of your text. Place each equation on a separate line and number your equations sequentially (Equation X).
- Avoid the use of first person pronouns whenever possible.
- In your writing develop your ideas from general to specific. Explain the forest before the group of trees before the specific tree before the specific leaf on the specific tree before the specific bug on the specific leaf on the specific tree.
- Where possible use schematics, pictures, graphs and tables rather than words. Captions should be placed above tables and below figures. Use tables when absolute numbers are important and graphs when trends are important. Always discuss a table or figure before presenting it. Explain to the reader how they should interpret the figure to avoid ambiguity.

**Structure of the Paper**

**Title Page:**
- Project Title
- Authors, Institution, Contact Information
- Prepared in partial fulfillment of the requirements of ME8243
- Instructor
- Date

**Abstract:** An abstract is not an introduction. It summarizes the main highlights of the work, including the results. Your abstract should be less than 250 words and not include any citations or figures. The abstract should include one or two sentences on each of the following sections:
  a) Background: A description of the problem and why it is being investigated.
  b) Methods: Briefly summarize the primary methods used in this project.
  c) Results: Briefly describe the major results of the project.
  d) Conclusions: Summarize the conclusion of the results and discuss the meanings of the interpretation. In other words, describe the implications of your findings

**Introduction:** The introduction needs to capture the reader and provide the context and background information needed to understand the rest of the paper. The introduction is also your chance to establish your knowledge in the field by comparing and contrasting the works of others to your work through your literature review. Basic format:
  a) Describe the context of the problem and why it is important.
  b) As you develop the problem, define any terms and educate the non-specialized reader as necessary.
  c) Discuss previous research in the area and how it relates to your work. Do not merely summarize the contributions of each article you find, but synthesize and interpret the results from all of your reading to find commonalities and differences. Discuss gaps in the research and how this leads into your work. This literature review should include both reference so similar mechanisms (possibly including patents) and references to kinematics synthesis and analysis literature.
  d) The last paragraph in the introduction outlines the remainder of the paper, providing the reader of a roadmap of what is to come.

**Body:** Divide the body of the paper into logical sections and subsections. Typical sections include:
a) **Methods:** Describe the methods of your work to the extent that a competent peer could reproduce your work. Give details about equipment used, sample preparation, data collection methods, computational methods, etc.

b) **Results:** Present the key results of the project without interpreting the meaning. Present the data through tables and figures as appropriate.

c) **Discussion:** Interpret the results of the project based on the framework you laid in the introduction. Do the results agree with your hypotheses or with what others have found? Why or why not? Discuss the theoretical and practical implications of your results.

d) **Conclusion:** Use the conclusion to summarize the significance of your results and provide a framework for future work. Provide an honest critique of your work, emphasizing the good, but also discussing the bad. Give direction for future work. Close the paper with the implications of your work.

**References:** List all of the references used in the paper. While current journals use a variety of citation styles, I recommend using ASME’s style as a baseline. Please see the last page of this handout for the guidelines that are directly from ASME’s author’s guide (http://journaltool.asme.org/Help/AuthorHelp/WebHelp/JournalsHelp.htm#Guidelines/Getting_S tarted.htm):

**Peer Reviews:** In the spirit of structuring this project in preparation for a paper worth of a conference or a journal publication, everyone in the class will participate in a peer review. This means that each paper will be reviewed by approximately three of your classmates. Reviews should be critical and constructive. Think about how your comments can be used to improve the paper. The peer review will be conducted completely electronically. When returning your peer review by e-mail, please cc the instructor. Each team will be expected to revise their paper based on the reviewer’s comments and document the revisions in a letter.

**Oral Presentation:** A group oral presentation will be made near the end of the term. Each team will have 25 minutes for the prepared presentation and 5 minutes for questions.

The oral presentation should include:
- **Introduction & Background:** Introduce yourselves and describe the motivation and objectives of your project. Provide sufficient background on your problem to set the stage for your work.
- **Methods:** Describe the highlights of your model development and design process.
- **Results:** Presents the results from your model.
- **Discussion:** Discuss the model results and how they were used to inform your design. Also describe the design trade-offs?
- **Conclusion:** Describe the lessons learned and areas for future work if you had the available time.

**Suggestions for Preparing PowerPoint Slides:**
- Simplify.
  - How many words can you remove from your slide and still make your point?
  - Communicate a single, clear idea on each slide.
  - Use keywords instead of sentences.
- Make the slide clearly readable from the last seat in the room.
- Use a font larger than 20 points.
- Make figures and drawing large, simple, and clear. Use bold lines.
- Label axes of graphs with large characters.

- Put a title every slide.
- Try to include a graphic on every slide.
  - Graphics convey more information than just text. They also help keep the attention of the audience.
- Standardize.
  - Stick with a single font style.
  - Try to standardize the size of your artwork.
- Use contrasting colors.
  - Black will not be readable on blue, green or red backgrounds.
  - Yellow will not be readable on a white background.
References

Within the text, references should be cited in numerical order according to their order of appearance. The numbered reference citation within text should be enclosed in brackets.

Example: It was shown by Prusa [1] that the width of the plume decreases under these conditions.

In the case of two citations, the numbers should be separated by a comma [1,2]. In the case of more than two references, the numbers should be separated by a dash [5-7].

List of References. References to original sources for cited material should be listed together at the end of the paper; footnotes should not be used for this purpose. References should be arranged in numerical order according to the sequence of citations within the text. Each reference should include the last name of each author followed by his initials.

(1) Reference to journal articles and papers in serial publications should include:
- last name of each author followed by their initials
- year of publication
- full title of the cited article in quotes, title capitalization
- full name of the publication in which it appears
- volume number (if any) in boldface (Do not include the abbreviation, "Vol.")
- issue number (if any) in parentheses (Do not include the abbreviation, "No.")
- inclusive page numbers of the cited article (include “pp.”)

(2) Reference to textbooks and monographs should include:
- last name of each author followed by their initials
- year of publication
- full title of the publication in italics
- publisher
- city of publication
- volume number (if any) in boldface if a single number, include, “Vol.” if part of larger identifier (e.g., “PVP-Vol. 254”)
- inclusive page numbers of the work being cited (include “pp.”)

(4) Reference to theses and technical reports should include:
- last name of each author followed by their initials
- year of publication
- full title in quotes, title capitalization
- report number (if any)
- publisher or institution name, city

Sample References


