MAE 656 - Advanced Computer Aided Design

06. CAD Project – Doc 01

Description of the Final Project

Outline

Section 1:

a. Description of the Final Project
b. Final project report and presentation

Section 2: Project Contents

a. Description of the problem solved
b. Description of the numerical model
c. Results obtained with the numerical model
d. Conclusions and summary

Description of the Final Project

The final project consist on solving, with Ansys Workbench, an structural component.

You have free choice to select the structure to be solved.

The level of complexity of the structure has to be reasonable:

Too easy 

Too complex 

Description of the Final Project

You can either verify an existing structure: knowing the dimensions and the loads applied to it, check that it fulfills all mechanical requirements.

Or you can design an structure: find out the most efficient geometry or material to fulfill some mechanical requirements.

Description of the Final Project

The simulated structure can be modeled with any type of FEM elements: beams, solids (2D and 3D) or shells. Or with any possible combination of these elements.

I encourage you to use shell elements as we hadn't had any week assignment with those.

Final Project Report and Presentation

You will have to present a written document (either in pdf, sent to x.martinez *"at"* upc.edu) or a paper copy.

You will also have to present the final project to the class in a 10 minutes presentation.

The report, and the class presentation, must contain the following sections:

a. Description of the problem solved
b. Description of the numerical model
c. Results obtained with the numerical model
d. Conclusions and summary

The contents of each one of these sections is further described.

Final Project Report and Presentation

The report should have an extension of 4,000 – 5,000 words (excluding tables and figures).

It will contain the same information included in the presentation, plus all additional information that you may consider of interest. In example:

- The model can be described with more detail
- If you have performed a convergence study, you should include this information.
- If you have designed the structure, you must include the different steps followed and the different models considered.

Final Project Report and Presentation

The final project presentation will be done on Thursday 9th and Friday 10th.

Each one of you will have 10 minutes to do the presentation. Afterwards we will have approximately 5 minutes to discuss the model presented.

The presentation will be evaluated by the students (each one of you) and by the professor (me).

Project Contents

In the following are described the project contents.

These are described in a ppt presentation similar to the one that has to be prepared.

MAE 656 - Advanced Computer Aided Design

Your Name

Place, Date

Title

Outline

1. Description of the problem solved
2. Description of the numerical model
3. Results obtained with the numerical model
4. Conclusions and summary

Description of the problem

In this section you must present the problem that will be solved (the real structure).

Among other parameters that you may consider necessary, you have to describe the motivation behind solving the problem, and the simplifications made on the model in order to simulate it with FEM.

You also have to describe the type of simulation chosen (beams, solids or shells) and justify its selection.

We have to understand the structure that you want to solve and you have to convince us that the simulation proposed is the best option.

Numerical model

In this section you have to describe the numerical model developed.

Among the elements that have to be described are the four main elements required to define the simulation: materials, geometry, mesh and boundary conditions (loads and supports).

In a presentation you may not have time to describe everything in detail, however the information provided should be sufficient to allow the audience to reproduce the model with slight differences.

> Example: The most important parameters of the mesh are the type of element used, the number of elements, the number of nodes and if it is structured or not. With this information I can generate a similar mesh, although it may not be the same.

Numerical model

The detailed model description must be included in the written report. This has to contain enough information of the model to allow the reader to reproduce the exact same model.

If you have performed iterations on the model, varying the geometry, or you have performed an study of convergence using different meshes, you have to explain it in the presentation. Again, in a presentation the audience wants to have a good idea of what you have done, not every single detail.

Numerical model

You have to give us enough information to allow us to replicate the model with slight differences: maybe I cannot obtain the same mesh or I define wrong the radii of curvature in a blended corner, however, this variations will not change the performance of the structure.

You have to show us that the model defined corresponds to the structure you want to simulate, considering the simplifications assumed.

Results

In this section you have to present all results that you may consider relevant to understand the structure performance.

You have to include also all results required to validate the structure.

The difference between these two types of results is the following:

- The maximum vertical deformation of a beam in a building is limited to the span/250.
- You should show this result (result required for validation) but you also have to show the total deformation, or the horizontal deformation. These deformations may not be required for validation but are necessary to understand the beam structural performance.

Results

The results shown will depend on the type of elements used to perform the simulation, as well as on the material of the structure (do not show Von-Mises stresses if your structure is made of concrete!)

To complete this section you must think on the information that will require the audience to understand the mechanical performance of your structure. You have to provide all this information. Basic information to be provided is the information that allows the structure to work as expected.

Conclusions and Summary

In this last section you must present a final summary of the structure simulated and the results obtained from the simulation.

Focus in those results required for the structure validation or design (if we were performing the simulation to reduce the thickness of a shell element, you have to remark the final thickness and, for example, the reduction of weight in the structure)

This last slide shows the main idea that you want the audience to keep from your whole presentation. Think on what idea you want us to keep. Think on what are the most relevant elements of your simulation. This is what you have to tell us here.

Final Comment on the Presentation

You may have been working on the structure that you are presenting for a couple of days, a couple of weeks or a couple of months. Therefore, your knowledge of the structure is really good and there are many aspects, elements, etc. that are obvious.

However, for the audience, this is the first time that they see the problem and they do know nothing about it. You have to put yourself in the audience position in order to have a good idea of what you must show and explain.

You can (and must) assume knowledge on the theory that lays behind the simulation. But assume an absolute ignorance of the simulation itself.

Final Conclusion (of the course)

FEM and CAE are great!

They allow us to solve structural components that cannot be solved otherwise. And we can have drawings with lots of colors!

However, if we want these colors to have a reasonable meaning, we have to:

- Know the theory that lays behind our formulation, to be sure that we are applying it correctly.
- Analyze critically the results obtained in order to know if they are coherent and meaningful.

Final Conclusion (of the course)

Be careful. A FEM code will always give you some sort of result (you have paid for it). You must work wisely to be sure that the result obtained is useful.

Besides being sure that the results are useful, you don't want to spend your whole life with one simulation. Be wise and reduce the cost of the simulation as much as possible:

- Use the most adequate elements.
- Apply all possible simplifications to reduce the computational cost.