



## End Semester Project

### Problem Statement

A wood beam is a structural support made from wood. They are most commonly used in wood frame structures like small houses, although they can be used in other types of construction as well. Beams are designed to resist bending when stressed by weight or forces like high winds. They are included in structural elements like floors and roofs to distribute the weight of the structure and provide support. Historically, wood was the most common construction material in many regions of the world and solid wood beams were a preferred method of structural support. The type of wood and size of the beam both play a role in how much weight a single wood beam will be able to bear. Dense, close-grained woods tend to be preferred because of their increased strength, as well as resistance to insects and rot. The wood beam can be cut in a solid block (rectangular), I, or H shape, depending on the needs of construction. You have started a business of making solid block wood beams and for this purpose, you may use any available wood to create the beam. Further, customers have the option to bring any raw wood of their own. The wood beam needs to be carefully calibrated to determine how much pressure it can withstand, that is, the strength of the beam. The first customer has brought raw wood with round log of diameter 74 inches. The goal is to find the dimensions of cross-section of the strongest beam that can be cut from a round log of given diameter. Draw a picture of this scenario on paper and label it. Since every customer will bring a different size raw wood, you have decided to use MATLAB/python to write a program which will provide you the optimal dimensions of the cross-section of the strongest beam. The program will take a round log of diameter as input and return the dimensions of the cross-section of the strongest beam after applying optimization technique(s) learnt in class.

### Program Requirements

1. The program must come with a detailed instructions manual explaining each line of the program and steps required to successfully run the program.
2. On (every) first run, the program must display name of your software house, and your programming team along with student ids.
3. At this stage, a message should be displayed to press any key to continue.
4. The program should ask the user to input round log of diameter of raw wood.



5. The program should apply the optimization technique learnt in class to find the solution. Relevant MATLAB/PYTHON commands should be used to find derivative and solution of the problem.  
Using the final equations obtained through by-hand solution will not result in any marks.
6. The dimensions of the beam should be displayed as output.
7. At this stage, the program must ask the user if they wish to run another query or terminate the program. Based on user input, program must act accordingly.

### Report Requirements

Students are required to submit a complete report of their project in their own words, including:

| Sr. No. | Deliverable  | Marks            |
|---------|--|------------------|
| 1.      | Objectives and introduction of the problem.  | 5 <sub>5</sub>   |
| 2.      | A step-by-step by-hand solution. Clearly state the assumptions and values that you use for the solution.   | 15 <sub>20</sub> |
| 3.      | A well commented MATLAB/PYTHON code with line-by-line explanation. This part must include the explanation of the commands, functions, and toolboxes used.  | 10 <sub>15</sub> |
| 4.      | A step-by-step example demonstrating the MATLAB/PYTHON solution. Also provide an instruction's manual to run the MATLAB program to obtain the MATLAB solution demonstrated in the example.             | 20 <sub>10</sub> |
| 5.      | Detailed results section. Present results and graphs of your analytical and MATLAB solution in this section, compare and discuss your results including their physical interpretation.                 | 10               |
| 6.      | Flowchart of the solution methodology.   | 5 <sub>5</sub>   |
| 7.      | 3D figure.   | 5                |
| 8.      | Conclusions. In this section include conclusions related to this project, summary of problem and results, the difficulties that you faced during this project and how you overcame those difficulties. | 5 <sub>5</sub>   |
| 9.      | Contribution. In this section clearly state the contribution of each group member. Generic statements such as 'each group member contributed equally' are not acceptable answers.                      | 5 <sub>5</sub>   |



Each report element should be documented under a separate heading. Report must not exceed 12 A4 size pages including table of contents as well as a single title page with project title, student names, ids, section, and name of the course. 3 marks will be deducted for every extra page. Each page should be numbered.

### **Project Submission Guidelines**

- This is a group project and carries 70 marks.
- A group can have maximum of 3 students.
- If a student wishes to work individually, they can submit individual project.
- Plagiarized work (from internet or fellow students) will result in zero marks.
- Deadline for complete project submission on google classroom (one MS Word file, one pdf of the same Word file and one program file) is Friday 10 Dec 2020 latest by 4:30PM.
- Do not submit your project via email, it will not be considered.
- Name of your project files must be as per following format: Section\_ID1\_ID2\_ID3. (e.g., B\_123456\_654321\_987654)
- 15 Marks will be deducted in case of missing hard copy of the project.
- Late submissions will not be considered.