**MAE 190**

**Winter 2024**

**Shaft Design Coding Project**

**A graph of a cylinder

Description automatically generated**

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**Introduction**

Shaft design is a challenging problem that requires a lot of hands calculation and iteration. In engineering, the best way to solve problems with a lot of iterative calculation is by automating the process. Coding up a shaft design problem seems simple at first, however, there are many challenges come with it. Problems that were faced during the process of code development were inputting a database, evaluate values from figured that are visually obtained by user and finally coming up with an intuitive user interface.

**Results**

The first challenge that immediately met in the development process was inputting material property Data from tables and chart from the textbook. During a manual shaft designing process, Table A-20 are used to look up the essential property of the material. To input this data base into the code quickly with the least manual data entry, an innovative use of AI was utilized. The data was quickly copied and pasted into chatGPT chat window without formatting with the request “format this into an excel friendly format” chatGPT quickly output a data that can be easily copied and paste into an excel file. Then the excel file was read by the code and a data base of material properties was created. Another benefit of storing the data in excel is that it the database property could easily updated by the user.

It can be seen that in the first block of the code the input material and data processing from excel was performed. Another challenge was obtaining the Kt and Kts values from Figure 6-20 and 6-21. Since these data are often visually obtained by user, it was necessary to use a formula that was provided by the professor to linearly fit and obtained these data.

The next big block of code was used to face the next challenge, creating a user-friendly interface. Matlab codes are often difficult to use with the command window input and output. To combat this, it was decided that an app-like user input interfaced was the best way to obtain user’s input.

This can be seen in the next block of code; the UI was designed by the MATLAB native app design program. The code for the UI from the app was then imported and embedded into the script, giving an extremely easy to use User interface with many required and optional options from Units and material selection to even convergence limit can be input by the user.

**A screenshot of a computer

Description automatically generated**

**Figure1:** User interface of the shaft design project program.

**Discussion**

**A graph with a blue line

Description automatically generatedA graph with a line

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**Figure 2:** Shaft size convergence and convergence data over many iterations

The shaft design program was able to design the shafts with a large range of stress in put convergence with less than 50 iterations.

**Conclusion**

The shaft design program is a great chance to learn how to automate a long and iterative process. It is also a great way to learn how to create an interactive UI. The advantage of the code is that it is faster than hand calculation and also give out a pretty sketch of the shaft and also an intuitive UI.