

# Chapter 9

## Graphical User Interface (GUI)

All the developed modules can be integrated together in one place to make a convenient GUI for ease of use of the practising engineers. So far, the overall framework of the GUI has been prepared in GNU Octave (open-source platform), in which the dynamic power flow module is already integrated. The other modules can be integrated into the GUI in a similar manner. The step-by-step demonstration of the developed GUI is shown below.

Figure 9.1 shows the very first pop-up window displayed after running the GUI. It shows the various features of the developed software. The user has to select one, and it will proceed accordingly.

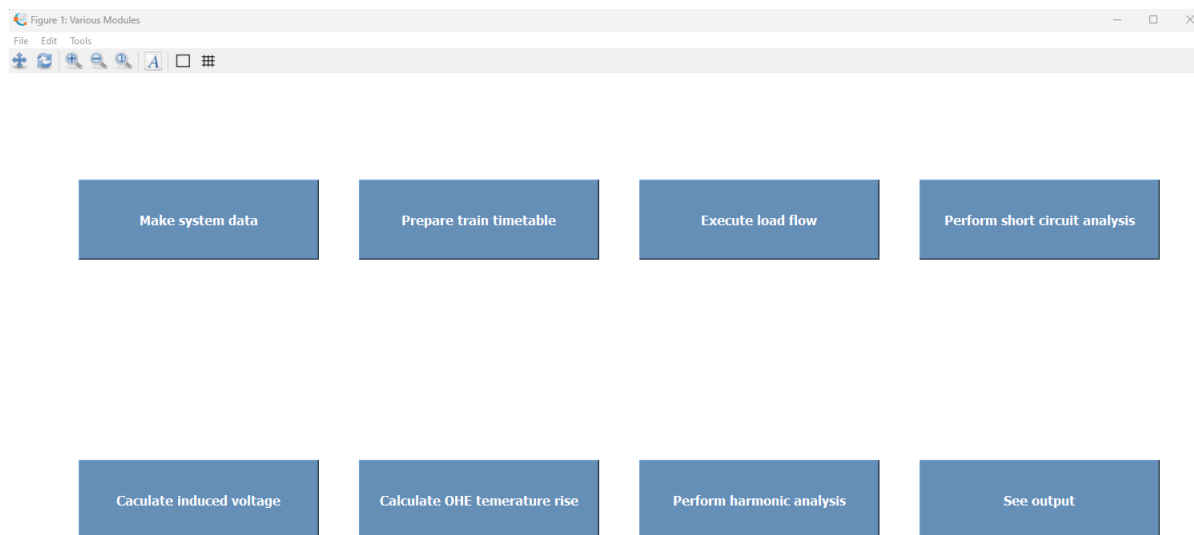


Figure 9.1: Pop-up window showing various modules

Figure 9.2 shows the pop-up window displayed after selecting the "Make system data" option. It asks the user whether he/she wants to prepare fresh data for a new system or edit the previously stored system data.

If the user selects the "Prepare Fresh Data" option, the pop-up window shown in Figure 9.3 will be displayed. It asks the user to enter the input data and the user has

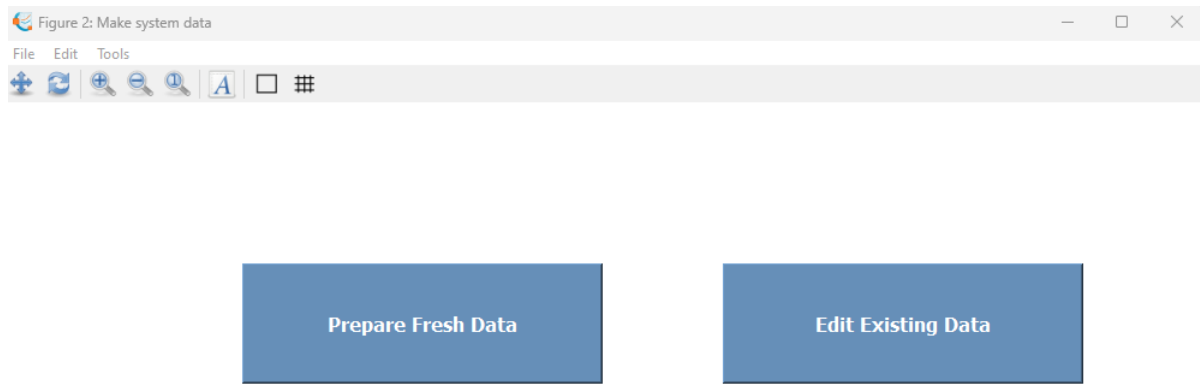


Figure 9.2: Pop-up window showing options for making system data

to enter the values accordingly. After entering all the asked values the user has to click on the "OK" button. Then the next pop-up window asking for the user inputs will be displayed as shown in Figure 9.4. In case the user missed entering any value and clicked "OK", then the pop-up window shown in Figure 9.5 will be displayed. It shows the default values to be used for the missing inputs. If the user wants to proceed with these values he/she has to select "OK" or else he/she can go back and re-enter the inputs by selecting the "Re-enter" option. The subsequent pop-up windows, after the one shown in Figure 9.4, asking for the user inputs are shown in Figures 9.6, 9.7 and 9.8.

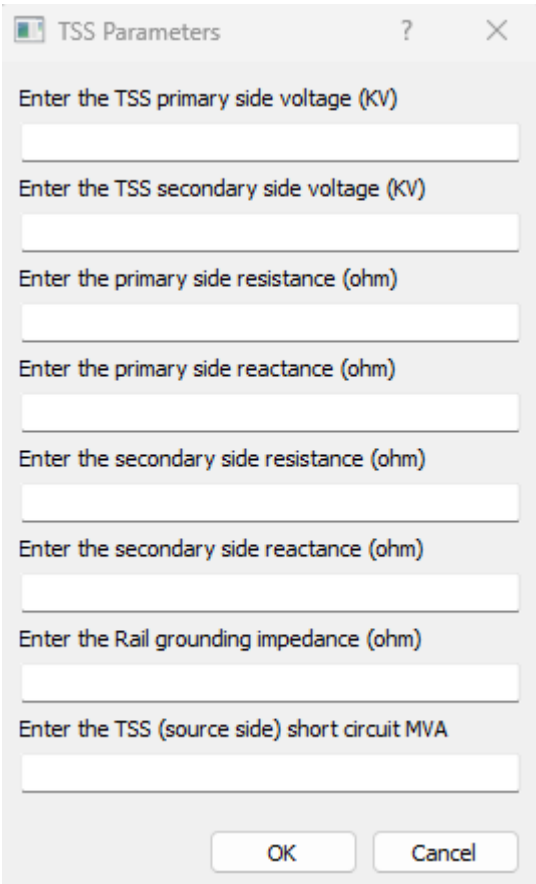
 A screenshot of a "User Input" dialog box. The dialog has a title bar with a question mark icon and a close button. It contains four text input fields, each preceded by a label: "Enter the number of TSS", "Enter the distance (in km) of all the TSSs measured from the starting point", "Enter the number of AT", and "Enter the distance (in km) of all the ATs measured from the starting point". At the bottom right of the dialog are two buttons: "OK" and "Cancel".

Figure 9.3: Pop-up window asking user inputs for number and location of TSS and AT

After entering the values and clicking on "OK" on the pop-up window shown in Figure 9.8, the next pop-up window shown in Figure 9.9 will be displayed asking the user to save the data file in .txt format by specifying the file location and file name. By doing so, the system data (.txt file) will be saved by a user-defined file name stored in a user-defined location.

If the user selects the "Edit Existing Data" option on the pop-up window shown in Figure 9.2, the next pop-up window shown in Figure 9.10 will be displayed asking the

user to select and open the existing system data file (.txt format). Then the user can edit the data in that file and save the updated system data.

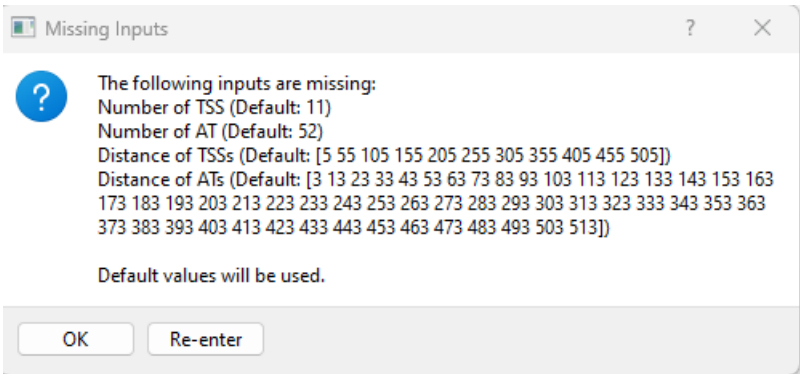


A dialog box titled "TSS Parameters" with a question mark icon and a close button. It contains seven input fields for the following parameters:

- Enter the TSS primary side voltage (KV)
- Enter the TSS secondary side voltage (KV)
- Enter the primary side resistance (ohm)
- Enter the primary side reactance (ohm)
- Enter the secondary side resistance (ohm)
- Enter the secondary side reactance (ohm)
- Enter the Rail grounding impedance (ohm)
- Enter the TSS (source side) short circuit MVA

At the bottom are "OK" and "Cancel" buttons.

Figure 9.4: Pop-up window asking user inputs for TSS parameters



A dialog box titled "Missing Inputs" with a question mark icon and a close button. It contains a blue question mark icon and the following text:

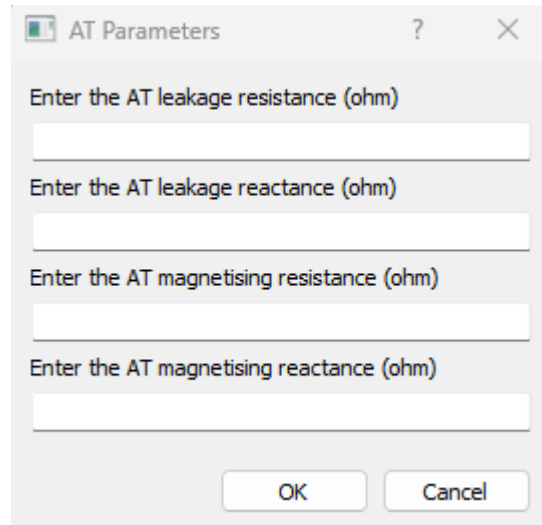
The following inputs are missing:  
 Number of TSS (Default: 11)  
 Number of AT (Default: 52)  
 Distance of TSSs (Default: [5 55 105 155 205 255 305 355 405 455 505])  
 Distance of ATs (Default: [3 13 23 33 43 53 63 73 83 93 103 113 123 133 143 153 163 173 183 193 203 213 223 233 243 253 263 273 283 293 303 313 323 333 343 353 363 373 383 393 403 413 423 433 443 453 463 473 483 493 503 513])

Default values will be used.

At the bottom are "OK" and "Re-enter" buttons.

Figure 9.5: Pop-up window showing missing inputs

Figure 9.11 shows the pop-up window displayed after selecting the "Execute load flow" option on the pop-up window shown in Figure 9.1. It shows the options for various tracks and the user has to select one for which he/she wants to execute the load flow. After the user selects any one track, the pop-up window shown in Figure 9.12 will be displayed asking the user to upload the system data file which has been prepared earlier. The user has to click on the "Upload" button. Then the pop-up window shown in Figure 9.13 will be displayed asking the user to select the data file. The user has



AT Parameters

Enter the AT leakage resistance (ohm)

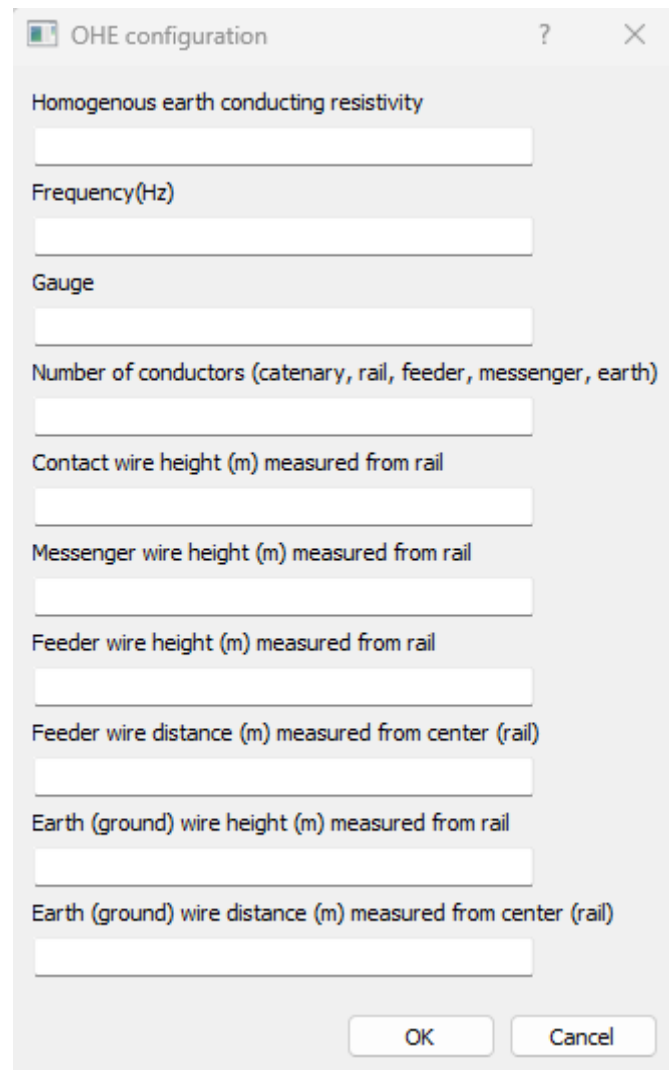
Enter the AT leakage reactance (ohm)

Enter the AT magnetising resistance (ohm)

Enter the AT magnetising reactance (ohm)

OK Cancel

Figure 9.6: Pop-up window asking user inputs for AT parameters



OHE configuration

Homogenous earth conducting resistivity

Frequency(Hz)

Gauge

Number of conductors (catenary, rail, feeder, messenger, earth)

Contact wire height (m) measured from rail

Messenger wire height (m) measured from rail

Feeder wire height (m) measured from rail

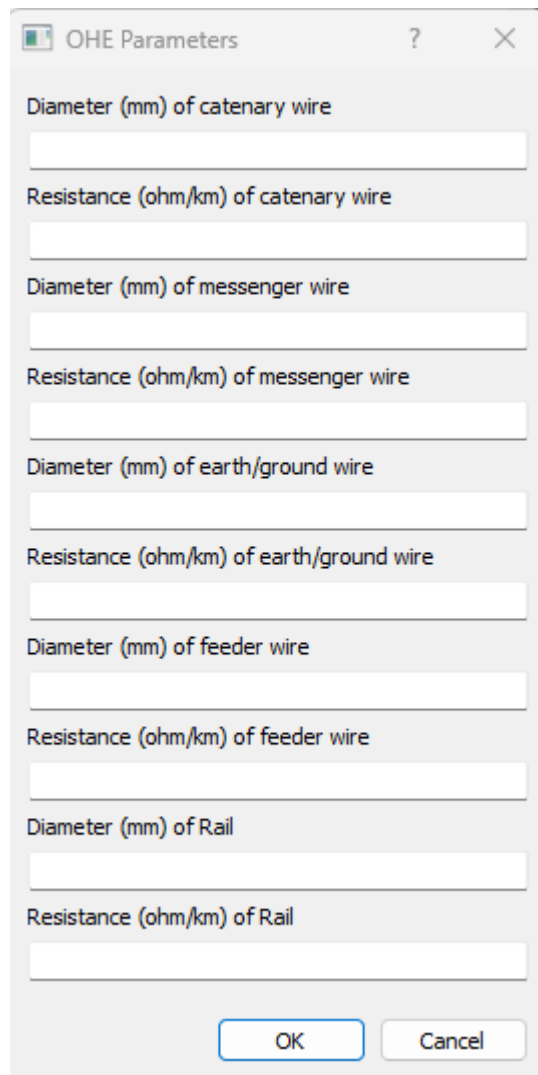
Feeder wire distance (m) measured from center (rail)

Earth (ground) wire height (m) measured from rail

Earth (ground) wire distance (m) measured from center (rail)

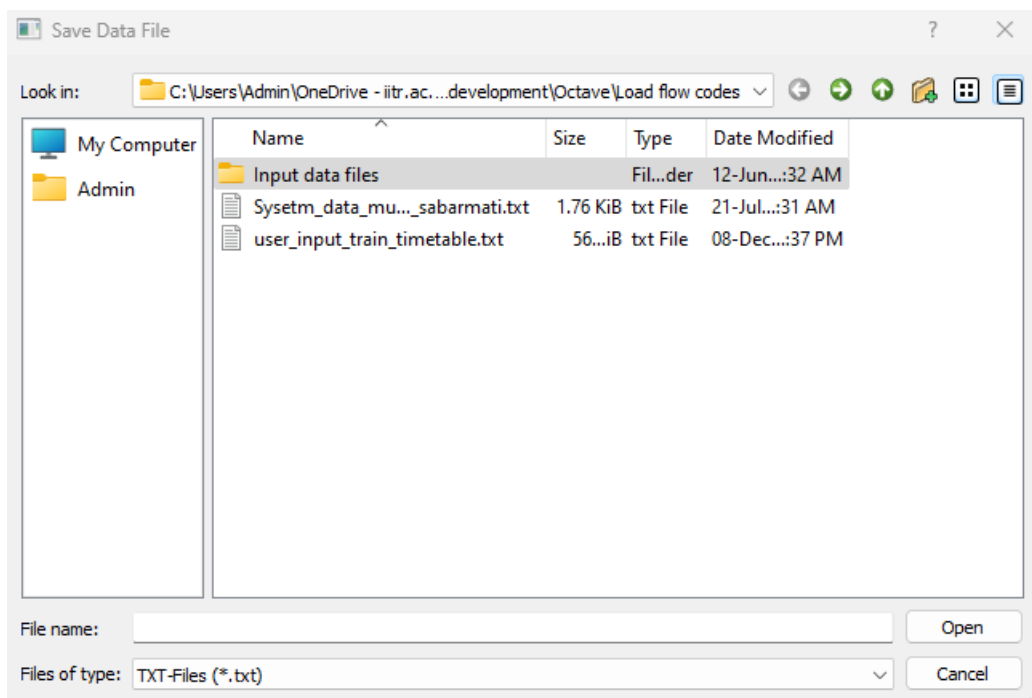
OK Cancel

Figure 9.7: Pop-up window asking user inputs for OHE orientation



A dialog box titled "OHE Parameters" with a question mark icon and a close button. It contains ten input fields for various parameters, each with a label above it. The parameters are: Diameter (mm) of catenary wire, Resistance (ohm/km) of catenary wire, Diameter (mm) of messenger wire, Resistance (ohm/km) of messenger wire, Diameter (mm) of earth/ground wire, Resistance (ohm/km) of earth/ground wire, Diameter (mm) of feeder wire, Resistance (ohm/km) of feeder wire, Diameter (mm) of Rail, and Resistance (ohm/km) of Rail. At the bottom are "OK" and "Cancel" buttons.

Figure 9.8: Pop-up window asking user inputs for OHE parameters



A "Save Data File" dialog box showing the file explorer view. The "Look in:" field shows the path "C:\Users\Admin\OneDrive - iitr.ac....development\Octave\Load flow codes". The left pane shows "My Computer" and "Admin". The right pane shows a list of files and folders:

Name	Size	Type	Date Modified
Input data files		Fil...der	12-Jun...:32 AM
Sysetm_data_mu..._sabarmati.txt	1.76 KiB	txt File	21-Jul...:31 AM
user_input_train_timetable.txt	56...iB	txt File	08-Dec...:37 PM

At the bottom, there is a "File name:" field, a "Files of type:" dropdown set to "TXT-Files (\*.txt)", and "Open" and "Cancel" buttons.

Figure 9.9: Pop-up window to save the data file

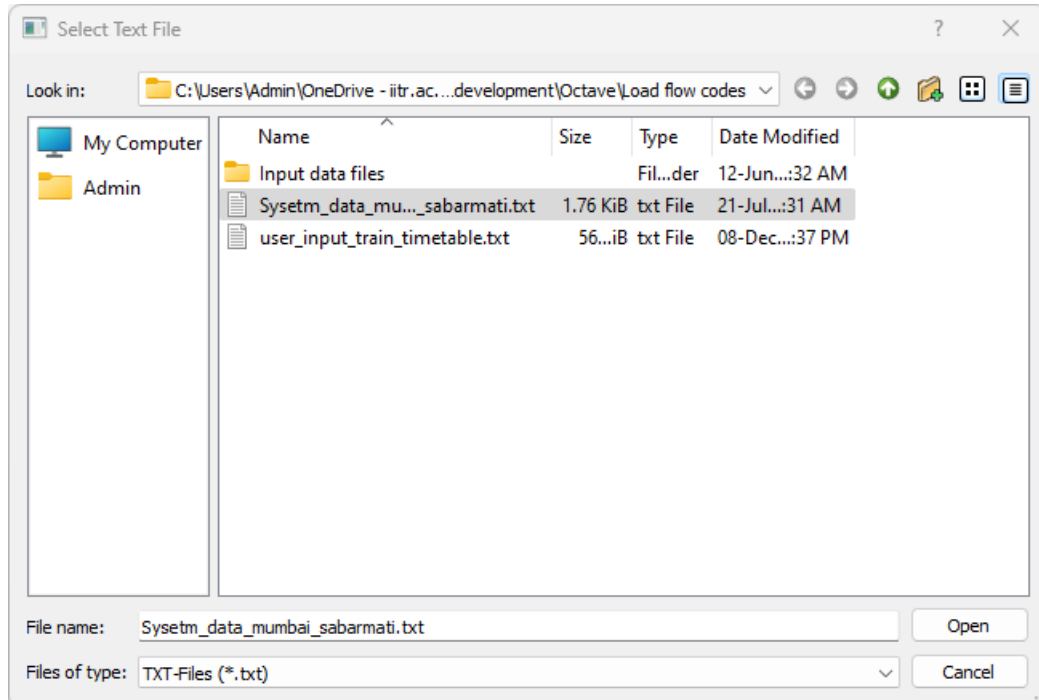


Figure 9.10: Pop-up window to open the existing data file

to select the specific file and click on the "Open" button. Then the pop-up window shown in Figure 9.14 will be displayed asking the user to upload the train timetable file which has already been generated using the train timetable module. The user has to click on the "Upload" button. Then the pop-up window shown in Figure 9.15 will be displayed asking the user to select the file. The user has to select the specific file which contains the train timetable and click on the "Open" button. Then the pop-up window shown in Figure 9.16 will be displayed asking for user inputs regarding train scheduling information. The user has to enter the values and click on the "OK" button, after which the load flow program will be executed at the backend.

Figure 9.17 shows the pop-up window displayed after selecting the "See output" option on the pop-up window shown in Figure 9.1. It shows the options for all modules' output and the user has to select one module whose output he/she wants to observe. After selecting the "Output of load flow" option, the pop-up window shown in Figure 9.18 will be displayed which shows the options of various tracks and the user has to select one whose load flow output he/she wants to see. After selecting any one track, the pop-up window shown in Figure 9.19 will be displayed. It shows various load flow output options and the user has to select one which he/she wants to see. After selecting the "Voltage at a particular time instant" option, the pop-up window shown in Figure 9.20 will be displayed asking the user to enter the time instant and distance resolution. The user has to enter the values and click on the "OK" button. Then a pop-up window shown in Figure 9.21 will be displayed which shows the desired output. The user can similarly observe the other output results of the load flow program.

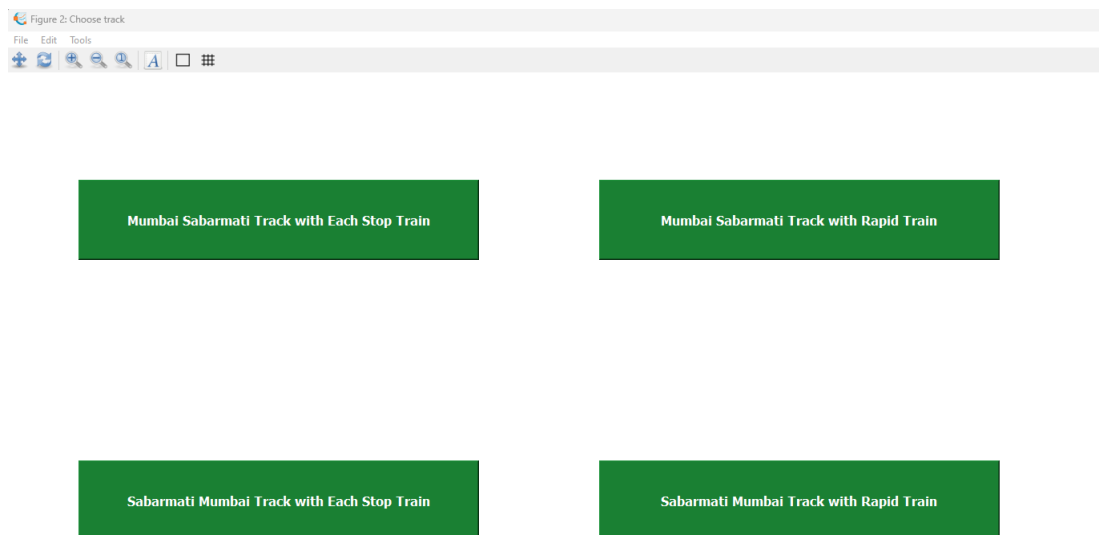


Figure 9.11: Pop-up window to select the track to execute its load flow

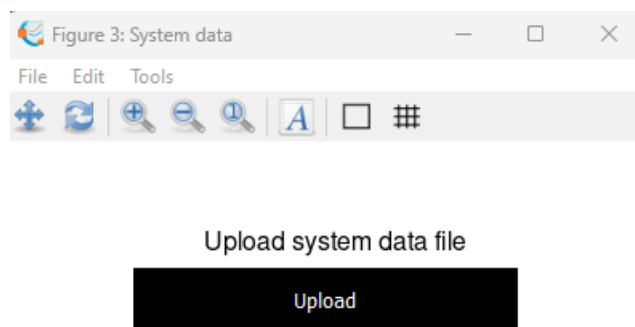


Figure 9.12: Pop-up window to upload the system data file

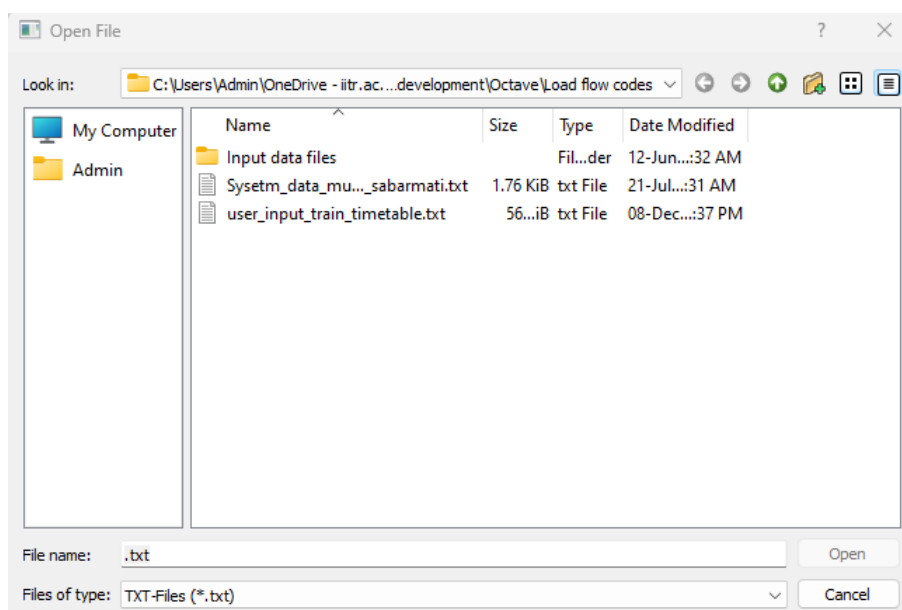


Figure 9.13: Pop-up window to open the system data file

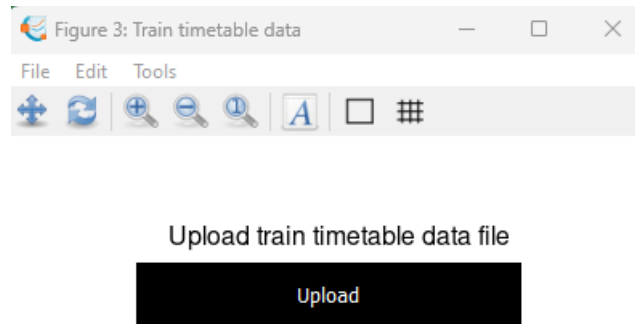


Figure 9.14: Pop-up window to upload the train timetable data file

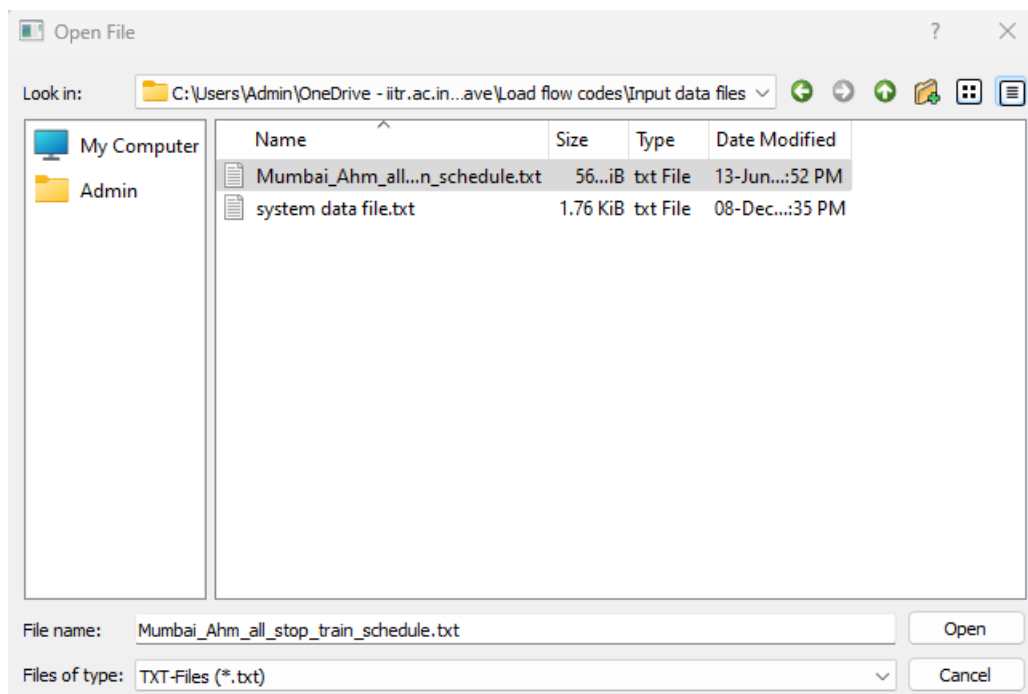


Figure 9.15: Pop-up window to open the train timetable data file

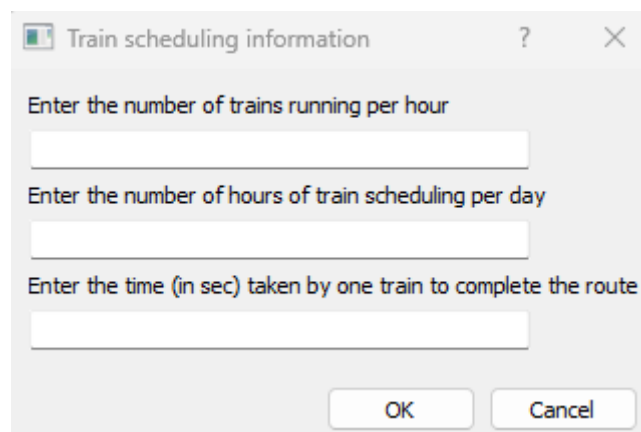


Figure 9.16: Pop-up window asking user inputs for train scheduling information



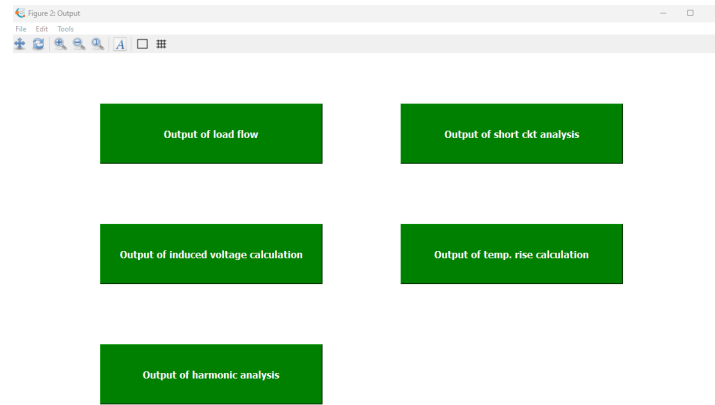


Figure 9.17: Pop-up window showing options for all modules' output

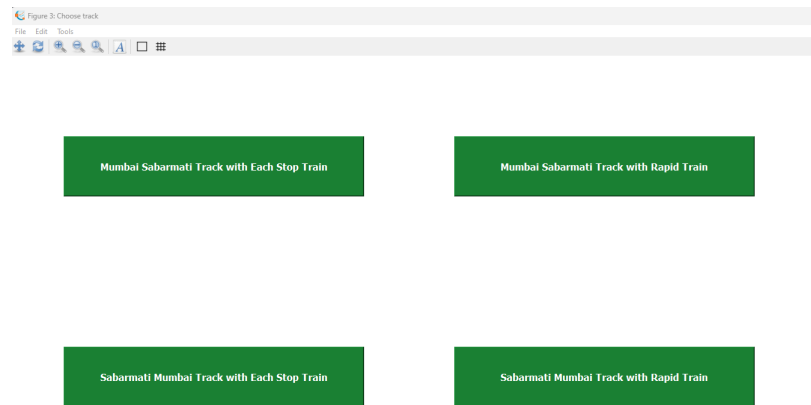


Figure 9.18: Pop-up window to select the track to see its load flow output

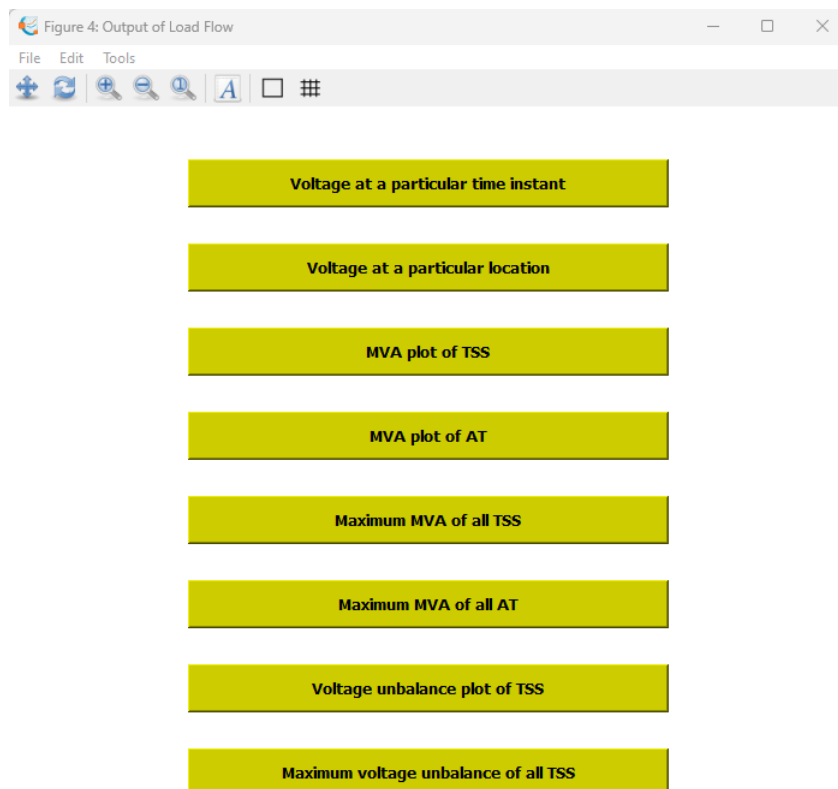


Figure 9.19: Pop-up window showing various load flow output options

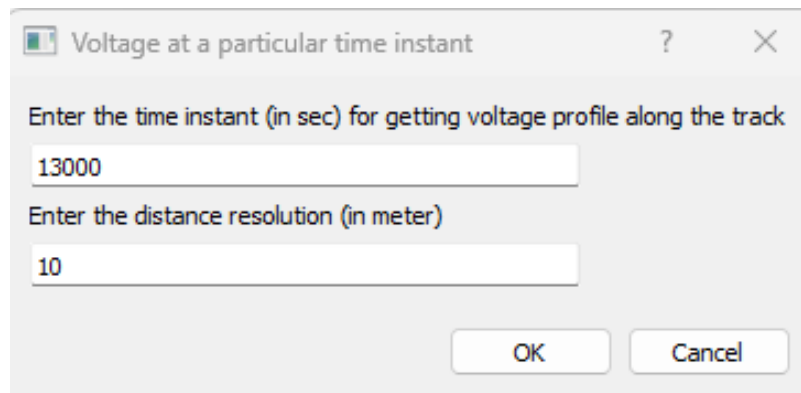


Figure 9.20: Pop-up window asking user inputs for obtaining voltage at a particular time instant

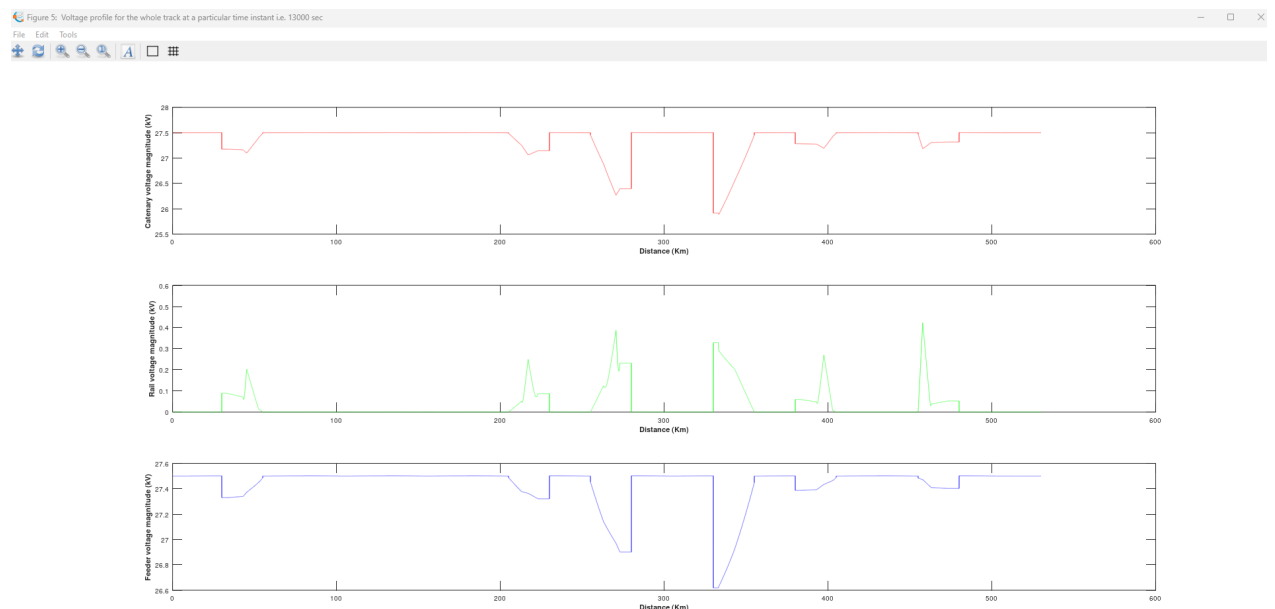


Figure 9.21: Pop-up window showing the plot for voltage at a particular time instant