Installing and Running the app.

Step 1: Install the 'UDComposites.mlappinstall' file through MATLAB application (R2019 and higher preferably).
Open MATLAB → Apps → Install App → Browse to the folder where the 'UDComposites.mlappinstall' file is saved → Click on Install app
The above process will install the app in MATLAB.

Step 2: Single Click on 'UDComposites' from apps section in MATLAB to run the app.

Using the app.

Step 1: We see 2 drop downs for entering material properties of Fibre and Matrix. Just selecting the material will update the properties in the section and they will not be editable. If some other value of the properties is to be entered, just choose 'Other' from drop down and enter the required properties.
The E2 and G12 values of Matrix are not editable in any case. They are calculated by assuming matrix to be isotropic.
Insert the fibre volume fraction. It should be in range [0,1].
Clicking on the button 'Calculate Effective Properties of Laminate' will update the fields for effective properties.

Step 2: After the effective properties are measured, we can plot different plots with respect to the angle theta which has been varied from [-90 to 90] degrees. Just clicking on the checkbox will plot the graph on the left part of the screen.

Step 3: Now we need to enter the Layup Sequence to calculate the A, B and D matrix. The Layup sequence should only be written in either of the two form **in degrees** –

1. **[0/45/-45/90]s** or **[0/45/-45/90]n**, where 's' denotes symmetric laminate and 'n' denotes any number of times the layer sequence is to be multiplied. Keeping position of 'n' blank will take default value 1 and the layup sequence will not be repeated.
   'n' should be a positive integer greater than or equal to 1.
   For eg. [0/45/-45/90]2 gives layup sequence to be [0, 45, -45, 90, 0, 45, -45, 90].

2. **[0/(45/-45/35)k/90]s** or **[0/(45/-45/35)k/90]n**, where 's' denotes symmetric laminate and 'k' and 'n' is any positive integer greater than or equal to 1. If left blank, the default value will be 1.
   For eg – [0/(45/-45/35)2/90]2 gives layup sequence as
   [0, 45, -45, 35, 45, -45, 35, 90, 0, 45, -45, 35, 45, -45, 35, 90]

Note: More than one pair of round brackets inside the square brackets are not programmed yet and may lead to error, there is no limit to number of angles inside the brackets though.

Step 4: Enter the total thickness of the laminate **in mm**. The laminate is assumed to have equal thickness of all the plies and the thickness is divided by total number of layers for each ply thickness. This has been implemented to calculate the A, B and D matrix.
Click on the button 'Calculate A, B and D matrix' to display the matrix on the right side. The A, B and D matrix has been combined in the form they are defined as-

$$\begin{matrix} A & B \\ B & D \end{matrix}$$

Step 5: Enter the **Forces in N/m** and **Moments in Nm/m** in their respective boxes.

Step 6: The strength parameters should be entered at the respective boxes in MPa. The default value of the strength parameters are for T300/BSL914c Epoxy which are taken for 0.537 fibre volume fraction.

Step 7: Click on 'Calculate Results'. This will display a table with different stresses and R for Hashin Failure criteria. The table also shows the mode of failure of the composites. If the composite is safe, it shows NA, otherwise it shows a particular mode of failure. We can also see the plots of stresses in laminate axes system and ply axes system or each layer varying along the thickness.
The A, B and D matrix and the final tabular data has been stored in 'results.xlsx' file which will be automatically created in the MATLAB working directory you are currently working in.