Python LEP Tutorial

The purpose of this tutorial is to show how to download and run Python LEP codes. For demonstration, we will use example LEP-T12-2.

Step 1: LEP File Download

a) Open chapter 12 LEP section and click on LEP-T12-2.py under Python Code section.

b) You should see that the file is downloaded at the bottom of the browser (if you are using Google Chrome). However, with Chrome browser, you will see a warning message "*This type of file can harm your computer...*" as shown below in blue box. We assure you that these files are safe and you may keep them on your computer by selecting "Keep" button as shown below by red circle.

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BY CHAPTER HIDE → BY CHAPTER HIDE → Cearning Resources -Summary Notes Learning Example Problems Professional Reference Shelf Additional HW Problems	Chapter 12: Steady-S Exchange Living Example Problems The following examples can be ac	State Nonisot	hermal React	t or Design: Flo	ow Reactors v	vith Heat	
FAQs Expanded Material BY CONCEPT HIDE Interactive Modules	Living Example Problem	Polymath™ Code	MATLAB Code	Python Code	Wolfram CDF Code *	AspenTech ™	
-Web Modules -Interactive Computer Games Living Example Problems	LEP Table 12-2 computer experiment	LEP-T12-2.pol	LEP-T12-2.zip	LEP-T12-2.py	EP-T12-2.cdf	-	
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This file will be stored at the location you have specified in your Chrome settings which can be Desktop, Downloads etc. If you don't know the stored location, follow **Step 2**, else go to **Step 3**.

Step 2: Knowing File Location

Right click on the downloaded file LEP-T12-2.py and choose "Show in Folder "as shown in above image. This will show the folder location where your file is stored.

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The following location page will appear. You can see here your downloaded file (shown below by red circle) and location (refer black circle). Remember your file location as it will be used later in **Step 6**. In this case the file is stored at Desktop.

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Step 3: Open Spyder Software

Make sure you have Spyder3 (Python 3.7) installed on your computer so that you can run the downloaded file. If you don't have Spyder 3 installed, then you can refer to Python Installation tutorial on CRE website (<u>http://umich.edu/~elements/5e/tutorials/python_installation_tutorial.pdf</u>).

To open Spyder, first locate the search box which is present at the bottom of your screen as shown below



Now type "spyder" to search for Spyder software and click on the circled icon shown below. This will open up Spyder.

Programs (2)
Reset Spyder Settings
Spyder
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You will see that the Python is loaded and following command windows will appear.

Spyder (Python 3.7)	-	
File Edit Search Source Run Debug Consoles Projects Tools V	iew Help	
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Editor - C:\Users\DELL\.spyder-py3\temp.py	Help	8×
🗅 temp.py 🛛	Source Console V Object	✓ ≙ 🌣
<pre>1 # -*- coding: utf-8 -*- 2 """ 3 Spyder Editor 4 5 This is a temporary script file. 6 """ 7 8</pre>	Usage Here you can get help of any object by pressing Ctrl+I in front of it, either on the Editor or the Console. Help can also be shown automatically after writing a left parenthesis next to an object. You can activate this behavior in Preferences > Help. New to Sovder? Read our tutorial Variable explorer	×
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	In [9]:	^

Step 4: Check Python Settings

To create a new window for graphs, you need to have your python "Backend" setting as "Automatic". If you already have this setting, you can go to **Step 6**, else follow below steps:

Go to To	ols option	present or	the top	menu ba	ar and	then select	Preferences
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This will open up following pop-up window. Click on "IPython console" option and then select Graphics tab present on top menu bar



Under Graphics, click on drop-down menu for Backend option and select Automatic. When you are done, Click Ok

General ^	Display Graphics Startup Advanced Settings	1
 Keyboard shortcuts Syntax coloring Python interpreter Run 	Support for graphics (Matplotlib) Activate support Automatically load Pylab and NumPy modules	
Current working direct	Graphics backend Decide how graphics are going to be displayed in the console. If	ľ
IPython console Iistory log	unsure, please select Inline to put graphics inside the console or Automatic to interact with them (through zooming and panning) in a separate window. Backend:	
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Step 5: Restart Python

Once you have made changes to Python settings, you need to restart kernel. A 'kernel' is a program that runs and introspects the user's code. To restart kernel, you can close the Python software and then re- open it.

As an easy step, follow below option:

Click on Settings icon present under Console 1/A and the click on "Restart kernel"

Variable explorer File explorer Help	
IPython marks	
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	Open an <u>I</u> Python console Ctri
In [3]:	C Restart kernel Ctri
	Connect to an existing kernel
	🖋 Rename tab
	Remove all variables
	Show environment variables
	😂 Show sys.path contents
	Show elapsed time

You will then be prompted to confirm your action. Click on Yes button.



Now, your settings has been applied successfully.

Step 6: Opening LEP File

Go to the file Menu and Click on Open. As a shortcut, you can also use keyboard button ' Ctrl+O '.

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Go to the place where your file (LEP-T12-2) is stored. In this case, file was stored at desktop as was identified in **Step 2**. If your file was saved at different location, then you should go to that location. After you have found the file, double click on "LEP-T12-2" to open it. This will open the codes for this LEP.

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Step 7: Executing the File

Step 7: Executing the File You will see that LEP-T12-2 is opened. Click on the run icon (>) as indicated in the image below to run the code.

Spyder (Python 3.7)	
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Editor - C:\Users\DELL\Desktop\LEP-T12-2.py	
🗅 untitled0.py 🗵 LEP-T12-2.py 🗵	
1 #%% 2 #Libraries 3 import numpy as np 4 from scipy.integrate import odeint 5 import matplotlib.pyplot as plt 6 import matplotlib as mpl 7 mpl.rcParams.update({'font.size': 18}) 8 from matplotlib.widgets import Slider, Button 9	
<pre>10 #%% 11 #Explicit equations 12 alpha = .0002 13 To = 330 14 Uarho = 0.5 15 Mc = 1000 16 Cpmc = 18 17 Hr = -20000 18 Fao = 5 19 thetaI = 1 20 CpI = 40 21 CpA = 20 22 thetaB = 1 23 CpB = 20 24 Cto = 0.3 25 Ea = 25000 26 def ODEfun(Yfuncvec, W, alpha,To, Uarho,Mc,Cpmc,Hr, 27 Fao, thetaI, CpI, CpA, thetaB, CpB, Cto,Ea):</pre>	

Now look for a new spyder window in the taskbar (shown below by red circle). Click on it to open this file which contains graph.



You will see a window (as shown below) displaying interactive Conversion, Temperature, & Heat profiles.

Click on Maximize button to generate the full graph size.



You will see following window. On the top left zone, you can see all the variables that you can play with and see the simultaneous effects on various graphs. You can also see a "Reset variables" button which initializes the variable values.



Step 8: Playing with Variables

Change the variable values by shifting slider on slider bar (with your mouse or touchpad). Observe the changes on the different plots. As you change the variable values, you can view the current value of variables by looking at the corresponding values displayed at the end of each slider (shown below by red rectangle)



Step 9: Reset Variables

If you wish to go back to the initial values of the variables, you can click on "Reset variables" button to initialize all the variables. This would change the values of all the variables to their initial values as shown below. You can see that after clicking "Reset variables" button, the graph becomes same as that of Step 7.



Step 10: Play

Change different variables and observe the change in various graphs. Draw your conclusions.