
ThinkDSP

Think DSP is an introduction to Digital Signal Processing in Python.

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The premise of this book (and the other books in the Think X series) is that if you know how to program, you can use that skill to learn other things. I am writing this book because I think the conventional approach to digital signal processing is backward: most books (and the classes that use them) present the material bottom-up, starting with mathematical abstractions like phasors.

With a programming-based approach, I can go top-down, which means I can present the most important ideas right away. By the end of the first chapter, you can decompose a sound into its harmonics, modify the harmonics, and generate new sounds.

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Here's a notebook that previews what you will see in Chapter 1:

- chap01preview.ipynb

And if you want to see where we are headed, here's a preview of Chapter 10:

- chap10preview.ipynb

Running the code

Most of the code for this book is in Jupyter notebooks. If you are not familiar with Jupyter, you can run a tutorial by clicking [here](#). Then select "Try Classic Notebook". It will open a notebook with instructions for getting started.

To run the ThinkDSP code, you have several options:

Option 1: Run the notebooks on Google Colab.

Option 2: Run the notebooks on Binder.

Option 3: Use Conda to install the libraries you need and run the notebooks on your computer.

Option 4: Use poetry to install the libraries you need and run the notebooks on your computer.

The following sections explain these options in detail.

Note: I have heard from a few people who tried to run the code in Spyder. Apparently there were problems, so I don't recommend it.

Option 1: Run on Colab

I have recently updated most of the notebooks in this repository so they run on Colab.

You can open any of them by clicking on the links below. If you want to modify and save any of them, you can use Colab to save a copy in a Google Drive or your own GitHub repo, or on your computer.

- [chap01.ipynb](#)
- [chap01soln.ipynb](#)
- [chap02.ipynb](#)
- [chap02soln.ipynb](#)
- [chap03.ipynb](#)
- [chap03soln.ipynb](#)
- [chap04.ipynb](#)
- [chap04soln.ipynb](#)
- [chap05.ipynb](#)
- [chap05soln.ipynb](#)
- [chap06.ipynb](#)
- [chap06soln.ipynb](#)
- [chap07.ipynb](#)
- [chap07soln.ipynb](#)
- [chap08.ipynb](#)
- [chap08soln.ipynb](#)
- [chap09.ipynb](#)
- [chap09soln.ipynb](#)
- [chap10.ipynb](#)
- [chap10soln.ipynb](#)
- [chap11.ipynb](#)
- [chap11soln.ipynb](#)

Option 2: Run on Binder

To run the code for this book on Binder, press this button:



It takes a minute or so to start up, but then you should see the Jupyter home page with a list of files. Click on [code](#) to open the folder with the notebooks, then click on one of the notebooks (with the .ipynb extension).

Option 3: Install Python+Jupyter

First, download the files from this repository. If you are a Git user, you can run

```
1 git clone --depth 1 https://github.com/AllenDowney/ThinkDSP.git
```

Otherwise you can download this Zip file and unzip it. Either way, you should end up with a directory called [ThinkDSP](#).

Now, if you don't already have Jupyter, I highly recommend installing Anaconda, which is a Python distribution that contains everything you need to run the ThinkDSP code. It is easy to install on Windows, Mac, and Linux, and because it does a user-level install, it will not interfere with other Python installations.

Information about installing Anaconda is [here](#).

If you have the choice of Python 2 or 3, choose Python 3.

There are two ways to get the packages you need for ThinkDSP. You can install them by hand or create a Conda environment.

To install them by hand run

```
1 conda install jupyter numpy scipy pandas matplotlib seaborn
```

Or, to create a conda environment, run

```
1 cd ThinkDSP
2 conda env create -f environment.yml
3 conda activate ThinkDSP
```

Option 4: Use poetry to manage the project on your computer or notebook locally.

First, download the files from this repository. If you are a Git user, you can run

```
1 git clone --depth 1 https://github.com/AllenDowney/ThinkDSP.git
```

Then, assuming you have poetry installed on your machine, run

```
1 cd ThinkDSP
2 poetry install
```

to install the libraries you need in a virtual environment. To activate the environment, run

```
1 poetry shell
```

Then you can run Jupyter.

Run Jupyter

To start Jupyter, run:

```
1 jupyter notebook
```

Jupyter should launch your default browser or open a tab in an existing browser window. If not, the Jupyter server should print a URL you can use. For example, when I launch Jupyter, I get

```
1 ~/ThinkComplexity2$ jupyter notebook
2 [I 10:03:20.115 NotebookApp] Serving notebooks from local directory: /
  home/downey/ThinkDSP
3 [I 10:03:20.115 NotebookApp] 0 active kernels
4 [I 10:03:20.115 NotebookApp] The Jupyter Notebook is running at: http:
  //localhost:8888/
5 [I 10:03:20.115 NotebookApp] Use Control-C to stop this server and shut
  down all kernels (twice to skip confirmation).
```

In this case, the URL is `http://localhost:8888`. When you start your server, you might get a different URL. Whatever it is, if you paste it into a browser, you should see a home page with a list of directories.

Click on `code` to open the folder with the notebooks, then click on one of the notebooks (with the `.ipynb` extension).

Select the cell with the import statements and press “Shift-Enter” to run the code in the cell. If it works and you get no error messages, **you are all set**.

If you get error messages about missing packages, you can install the packages you need using your package manager, or install Anaconda.

If you run into problems with these instructions, let me know and I will make corrections. Good luck!

Freesound

Special thanks to Freesound (<http://freesound.org>), which is the source of many of the sound samples I use in this book, and to the Freesound users who uploaded those sounds. I include some of their wave files in the GitHub repository for this book, using the original file names, so it should be easy to find their sources.

Unfortunately, most Freesound users don't make their real names available, so I can only thank them using their user names. Samples used in this book were contributed by Freesound users: iluppai, wcfl10, thirsk, docquesting, kleeB, landup, zippi1, themusicalnomad, bcjordan, rockwehrmann, mar-chascon7, jcveliz. Thank you all!

Here are links to the sources:

<http://www.freesound.org/people/iluppai/sounds/100475/>

<http://www.freesound.org/people/wcfl10/sounds/105977/>

<http://www.freesound.org/people/Thirsk/sounds/120994/>

<http://www.freesound.org/people/ciccarelli/sounds/132736/>

<http://www.freesound.org/people/KleeB/sounds/180960/>

<http://www.freesound.org/people/zippi1/sounds/18871/>

<http://www.freesound.org/people/themusicalnomad/sounds/253887/>

<http://www.freesound.org/people/bcjordan/sounds/28042/>

<http://www.freesound.org/people/rockwehrmann/sounds/72475/>

<http://www.freesound.org/people/marcgascon7/sounds/87778/>

<http://www.freesound.org/people/jcveliz/sounds/92002/>