

Datafiles for PINN Exercise (Section 5.8)

Reference data for the one-dimensional steady non-linear advection-diffusion-reaction equation.

Regimes available:

- $P_e = 0.01, Da = 0.01$: Diffusion dominates (Diff)
- $P_e = 20, Da = 0.01$: Advection dominates (Adv)
- $P_e = 0.01, Da = 60$: Reaction dominates (React)
- $P_e = 15, Da = 40$: Advection and reaction dominate (AdvReact)

Loading the data:

Method 1: You can load all four reference solutions stored in `RefData.pkl`. To do this, use the following python script

```
import pickle

with open('RefData.pkl', 'rb') as fp:
    RefDataDict = pickle.load(fp)
```

`RefDataDict` will be a python dictionary with the string keys `'Diff'`, `'Adv'`, `'React'`, `'AdvReact'`. You can use the command `RefDataDict.keys()` to see the keys.

The value of each key is a list containing three items: P_e , Da , and a two-columned array containing the $(x, u(x))$ pairs of the reference solution. For example,

`RefDataDict['Adv'][0]` will be 20, `RefDataDict['Diff'][1]` will be 0.01, and `RefDataDict['Adv'][2]` will be an 2D array with shape $N \times 2$.

Method 2: The reference data for the four regimes have also been provided in the files

`Pe_0.01_Da_0.01.txt`, `Pe_20_Da_0.01.txt`, `Pe_0.01_Da_60.txt`, `Pe_15_Da_40.txt` where the file names point to the various regimes. You can load these

files directly by ``` import numpy as np

```
ref1 = np.loadtxt('Pe0.01Da0.01.txt') ref2 = np.loadtxt('Pe20Da0.01.txt') ref3 =  
np.loadtxt('Pe0.01Da60.txt') ref4 = np.loadtxt('Pe15Da40.txt') ```
```

Additional regimes: If you are interested in testing the PINN out with other regimes, we have also provided a MATLAB script `ref_sol_gen.m` to generate the new reference solutions. In this script, you should change `fname` to a new file name to save to, and change the values of `Pe` and `Da` in the function `dydx`. Note, you may need to change the initial guess in the function `guess` to converge to a positive solution of the non-linear problem.