

# Bayesian Force Inference on Google colab notebook

## 6. Bayesian force inference

If you want to change the scale of the color bar, change tmin = 0.6 and tmax = 1.5 for tension and -0.02, 0.025 for pressure in the last two lines.

```
[11] import os
import sys

## Move to the directory set in step 5
if selected_curr_dir:
    os.chdir(selected_curr_dir)
    print("Current working directory:", os.getcwd())
    sys.path.append(os.getcwd())
else:
    print("Error: No directory selected. Please select the current working directory first.")

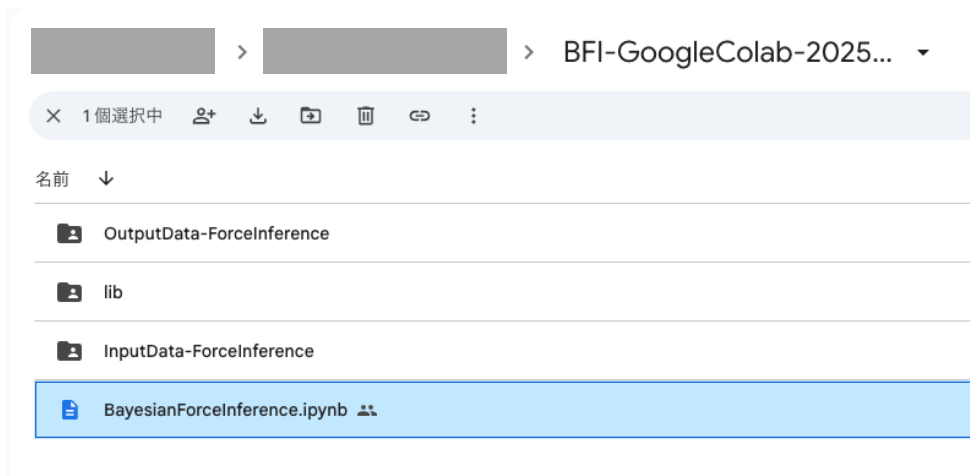
## Import the modules
import lib_forceinf.lib
import lib_out.lib
import lib_EBayesSP
import lib_DataInf as NDI
import time
import numpy as np
import pandas as pd
import scipy.sparse as sp
import matplotlib.pyplot as plt

print("==== Load file =====")
if 'selected_file' not in globals() or selected_file is None:
    raise ValueError("No input file is selected")

if 'selected_out_dir' not in globals() or selected_out_dir is None:
    raise ValueError("No output directory is selected")
```

## How to analyze test data

## Step 0 Upload files to your Google drive



Make sure that you put BayesianForceInference.ipynb and lib/ in the same directory (YourDirectory/BayesianForceInference.ipynb, Your Directory/lib/).

## Step 1 Install modules

### ✓ 1. Install modules

```
[1] !apt-get update
    !apt-get install -y build-essential
    !apt-get install -y libffi-dev
    !apt-get install -y libblas-dev liblapack-dev
    !apt-get install -y libsuitesparse-dev

    !pip install numpy scipy cffi
    !pip install ipyfilechooser

    !pip install git+https://github.com/yig/PySPQR.git
```

## Step 2 Mount your Google Drive

### 2. Mount your Google Drive

You must re-mount Google Drive in the following cases:

- Your Colab session is terminated (e.g., inactive for too long).
- Your internet connection is lost, causing a session reset.
- You reboot the runtime (e.g., via "Runtime" → "Restart runtime").

```
✓ 17 秒 [3] from google.colab import drive  
drive.mount('/content/drive')
```

Mounted at /content/drive

You must re-mount Google Drive in the following cases:

- Your Colab session is terminated (e.g., inactive for too long).
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- You reboot the runtime (e.g., via "Runtime" → "Restart runtime").

## Step 3 Select input file

### 3. Select input file

```
✓ 0 秒 [4] from ipyfilechooser import FileChooser  
from IPython.display import display  
  
global selected_file  
selected_file = None  
  
# Input file chooser  
chooser = FileChooser('/content/drive/MyDrive')  
chooser.title = "<b>Select your input file</b>"  
chooser.show_only_dirs = False  
chooser.use_dir_icons = True  
  
display(chooser)  
  
def set_input_file_path(chooser):  
    global selected_file  
    selected_file = chooser.selected  
    if selected_file:  
        print("Selected file:", selected_file)  
    else:  
        print("No file selected.")  
  
chooser.register_callback(set_input_file_path)
```



Select your input file

Change /content/drive/MyDrive/Code-to-Github/BFI-GoogleColab-202502/InputData-ForceInference/Vertex/VDat\_140408-T001.dat

Selected file: /content/drive/MyDrive/Code-to-Github/BFI-GoogleColab-202502/InputData-ForceInference/Vertex/VDat\_140408-T001.dat

## Step 4 Select output directory

### 4. Select output directory

```
✓ 0 秒 from ipyfilechooser import FileChooser
from IPython.display import display

global selected_out_dir
selected_out_dir = None

# Output directory chooser
out_chooser = FileChooser('/content/drive/MyDrive/')
out_chooser.title = '<b>Select output directory</b>'
out_chooser.show_only_dirs = True
display(out_chooser)

def set_output_dir_path(change):
    global selected_out_dir
    selected_out_dir = out_chooser.selected_path
    if selected_out_dir is not None:
        print("Selected ouput directory:", selected_out_dir)
    else:
        print("No ouput directory is selected")

out_chooser.register_callback(set_output_dir_path)
```

Select output directory

Change /content/drive/MyDrive/Code-to-Github/BFI-GoogleColab-202502/OutputData-ForceInference/

Selected ouput directory: /content/drive/MyDrive/Code-to-Github/BFI-GoogleColab-202502/OutputData-ForceInference

## Step 5 Select the current working directory

### 5. Select the current working directory

Select the directory you put this notebook, BayesianForceInference.ipynb.

```
✓ 0 秒 from ipyfilechooser import FileChooser
from IPython.display import display

global selected_curr_dir
selected_curr_dir = None

# Current directory chooser
curr_dir_chooser = FileChooser('/content/drive/MyDrive/')
curr_dir_chooser.title = '<b>Select the current working directory</b>'
curr_dir_chooser.show_only_dirs = True
display(curr_dir_chooser)

def set_curr_dir_path(chooser):
    global selected_curr_dir
    selected_curr_dir = chooser.selected_path
    if selected_curr_dir:
        print("Selected current working directory:", selected_curr_dir)
    else:
        print("No working directory selected.")

curr_dir_chooser.register_callback(set_curr_dir_path)
```

Select the current working directory

Change /content/drive/MyDrive/Code-to-Github/BFI-GoogleColab-202502/

Selected current working directory: /content/drive/MyDrive/Code-to-Github/BFI-GoogleColab-202502

## Step 6 Run Bayesian Force Inference

### 6. Bayesian force inference

If you want to change the scale of the color bar, change  $t_{min} = 0.6$  and  $t_{max} = 1.5$  for tension and  $-0.02, 0.025$  for pressure in the last two lines.

```
[11] import os
import sys

## Move to the directory set in step 5
if selected_curr_dir:
    os.chdir(selected_curr_dir)
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else:
    print("Error: No directory selected. Please select the current working directory first.")

## Import the modules
import lib.ForceInf_lib
import lib.Out_lib
import lib.EBayesSP
import lib.OgitaInf_NL as NOgi
import time
import numpy as np
import pandas as pd
import scipy.sparse as sp
import matplotlib.pyplot as plt

print('\n# ===== Load file =====')
if 'selected_file' not in globals() or selected_file is None:
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```

## Step 7 Calculate the Batchelor stress tensor

### 7. Calculate the stress tensor



Batchelor stress tensor:  $\sigma = \frac{1}{A} \left( -\sum_i P_i A_i \mathbf{I} + \sum_{[ij]} T_{ij} \frac{\mathbf{r}_{ij} \otimes \mathbf{r}_{ij}}{|\mathbf{r}_{ij}|} \right)$



```
▶ A = np.array([cell[i].area for i in range(len(cell))])
A_all = np.sum(A)
r = np.array([edge[i].dx, edge[i].dy] for i in range(E_NUM))
T = np.array([T[i] for i in range(E_NUM)])



I = np.eye(2)
P_term = -sum(P_i * A_i for P_i, A_i in zip(P, A)) * I
T_term = sum(T_ij * np.outer(r_ij, r_ij) / np.linalg.norm(r_ij) for T_ij, r_ij in zip(T, r))
stress_tensor = (P_term + T_term) / A_all

print("Stress tensor: ")
print(stress_tensor)
```

## Output files in your output directory

 VDat\_140408-T001\_TP.txt 

 VDat\_140408-T001\_Tension.png 

 VDat\_140408-T001\_stress.txt 

 VDat\_140408-T001\_Pressure.png 

```
# edge tension : edge_id, inf.tension, --, (x1 y2), (x2 y2)
0 1.137981e+00 -- (57.000 -112.000) (39.000 -114.000)
1 1.062750e+00 -- (416.000 -153.000) (404.000 -166.000)
2 9.992937e-01 -- (773.000 -152.000) (762.000 -160.000)
3 8.529784e-01 -- (88.000 -152.000) (87.000 -162.000)
4 9.244214e-01 -- (661.000 -151.000) (658.000 -164.000)
5 8.790851e-01 -- (389.000 -151.000) (386.000 -160.000)
```

```
# cell pressure : -- cell_id, inf.pressure
-- 0 -3.868644e-03
-- 1 -2.682924e-02
-- 2 -2.460718e-03
-- 3 1.607967e-04
-- 4 1.077298e-03
-- 5 -3.294638e-02
```