

Fall 2019:
Computational and Variational Methods for Inverse Problems
GEO 391/CSE 397/ME 397/ORI 397

hIPPYlib insructions

hIPPYlib implements state-of-the-art scalable adjoint-based algorithms for PDE-based deterministic and Bayesian inverse problems. It builds on FEniCS for the discretization of the PDE and on PETSc for scalable and efficient linear algebra operations and solvers. FEniCS needs to be built with the following dependencies:

- `numpy, scipy, matplotlib, mpi4py` ,
- PETSc and `petsc4py` (version 3.7.0 or above),
- SLEPc and `slepc4py` (version 3.7.0 or above),
- PETSc dependencies: `parmetis, scotch, suitesparse, superlu_dist, ml, hypre`,
- (optional): `mshr, jupyter`.

In this class we will use the development version of hIPPYlib that supports FEniCS 2019.1.0. The instructions on various installation options can be found here: <https://hippylib.readthedocs.io/en/latest/installation.html>, including installation of specific FEniCS version and hIPPYlib itself.

Note: a customized FEniCS docker image or customized conda packages is needed at this moment.

FEniCS installation

For Linux or MacOS users the most straight-forward approach is to create a conda environment:

```
conda create -n fenics-2019.1 -c uvilla -c conda-forge fenics==2019.1.0 \
    matplotlib scipy jupyter
```

Note: You need to specify the channel `-c uvilla` to use the hippylib-patched version of FEniCS 2019.1.

For Windows users the alternative is to use Docker (can be also used with Linux/MacOS if desired):

```
docker run --name hippylib-nb -w /home/fenics/hippylib -v \
    $(pwd):/home/fenics/hippylib -d -p 127.0.0.1:8888:8888 \
    hippylib/fenics 'jupyter-notebook --ip=0.0.0.0'
docker logs hippylib-nb
```

With the supported version of FEniCS installed, hIPPYlib can be installed via pip (if using docker, install from within the corresponding docker environment)

```
pip install hippylib[notebook] --user
```

Alternatively, **hIPPYlib can be used without installation**. One can download the files by navigating to the directory in which to store hIPPYlib and clone the files from GitHub:

```
git clone https://github.com/hippylib/hippylib.git
```

After this, one can run any application/notebook that uses hIPPYlib by including the path to the directory, containing hIPPYlib (see, for example, `InexactNewtonCG.ipynb`), as well as the applications/tutorials provided with hIPPYlib without any extra modifications.