Instruction for ADEF1 Solver Software

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1 Introduction

ADEF1 solver software is divided into two parts. Multilvel implementation requires matrices at all levels from finest to coarsest. The data files are constructed in Matlab and subsequently are written into `.DAT` files. Important part of ADEF1 solver sotware is part which implements multilevel preconditioner. This is implemented in `PETSc`, which calls the `.DAT` files on run time.

Structure Main directory `Adef1_Software` contains two sub-directorows; `ConstructDatFiles` and `PetscSolver`.
The directory `ConstructDatFiles` constructs data files.

2 How to install PETSc

Usint ADEF1-Solver will require PETSc to be configured on machine.This solver has been written in PETSc 3.3-7 verion. It is suggested to install similar version. Installtion with complex scalar is necessary, as PETSc solver will not recognize real scalars/matrices for reading from data files. With the assumptions that no blas lacpack, no mpich are downloaded, installtion follows as :

```
> gunzip -c petsc-3.3-p7.tar.gz | tar -xof -

>./configure --with-cc=gcc --with-cxx=g++ --with-fc=gfortran
--download-fblaslapack --download-mpich --with-scalar -type=complex

> make all test
```

PETSc is ready.

3 Constructing DATA files

Add the directory `ConstructDatFiles` to Matlab path also AddPath of your PETSC `matlab-bin` directory in matlab session or adapt path in program

`MainMarmousi.m`.

Run the program `MainMarmousi.m` It will ask for options in an input dialogue box. Those options are as following;
THat program construct discrete matrices according to provided options.

Frequency f	Give values f = 1, 10, 20 or 40
Meshsize	In terms of grid points per wavelenth. Choose 10 or 20.
Real shift	Real shift in complex shifted Laplace preconditioenrr CSLP, choose whatever you want to use as CSLP.
Imag. shift	Imaginary shift in complex shifted Laplace preconditioenrr CSLP, choose whatever you want to use as CSLP.
Damping	Damping parameter in equation.

An example is shown in Figure 1.

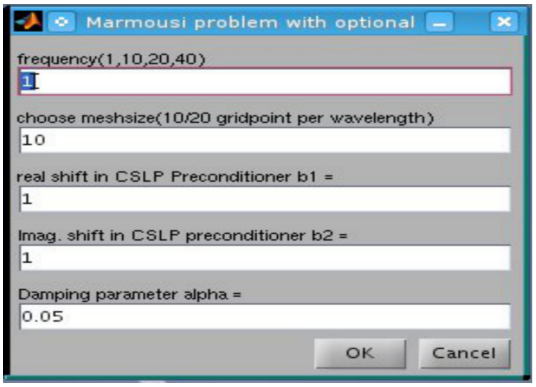

Figure 1: Menu to choose options while constructing `.DAT` files.

Recommended: First test run with defaults option in order to check if it runs smoothly. Subsequently customize with options.

Output file will be a .DAT file and will be saved in directory ../DAtaFiles/ with customized name `fN1gpWLN2aN3.dat` where f,gpWL,and a are constant where N1, N2 and N3 will customized according to options. For example f1gpWL10a0.05.dat, is data set with frequency $f = 1$, number of $gp/wl = 10$ and damping parameter $a = 0.05$.

3.1 How to adapt

PLEASE NOTE WHEN ADAPTING,
Reading `FILENAME.dat` file in Petsc is sensible of orders of things(matrices

and vectors) written in `.dat` file. If you wish to adapt, adapt it carefully. Take care of the order, persist with same order while writing into .dat file and reading same `.dat` file.

The directory `PetscSolver` implements the ADEF1 solver.

4 Solving part of software

In the terminal, go to the target directory; Compile the program as follows

```
> make GMGcycle.o; make MLadef.o; make MainSolver
```

subsequntly execute the executable program and provide with data file with "-f" as follows:

```
> ./MainSolver -f /your/path/to/datafile.dat.
```

This executuion accept all the possible runtime PETSc options. These all options can be listen by executing program with "-help".