ANISOFLOW Users manual

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Chapter 1

License

1.1 Copyright

1.2 Disclaimer

Chapter 2

Introduction

ANISOFLOW is a program that solves the groundwater flow in a computing parallel environment. The groundwater equation is solved with three different finite difference methods, where is taken into account heterogeneity and anisotropy mediums.

The main philosophy of ANISOFLOW is to capture the anisotropies of the medium into the flow, for that purpose the program has three ways to carry the calculus. The first one is the most usual method used to solve the groundwater equation, a scheme of seven blocks on finite difference, used by MODFLOW and the most popular programs to analyze aquifers. The second one is the finite difference equation proposed by Li, et al (2014) using a scheme of 19 blocks. And the last one is a finite difference scheme of 19 blocks we have proposed to attack the anisotropy of the mediums.

ANISOFLOW was built over PETSc libraries, which means ANISOFLOW has the PETSc advantages on the resolution of the linear systems: grid management, methods to solve the systems, preconditioning techniques to accelerate iterative processes, monitoring of solving process, portability, among others.

Chapter 3

Installing ANISOFLOW

ANISOFLOW can be installed in Unix and Widows systems, but we highly recommend install it over Unix systems.

3.1 Prerequisites

To install ANISOFLOW you must have the following programs in your system:

- Fortran and C compiler
- BLAS libraries
- LACPACK libraries
- MPICH libraries
- HDF5 libraries connected with PETSc libraries (optional and recommend)
- PETSc 3.7 libraries

By our experience, we know the most painful part of ANISOFLOW installation is installing their prerequisites, therefore, this chapter is focused of how to install those things on Linux, Mac and Widows.

3.2 Linux

3.2.1 Preparing the system

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3.2.2 Fortran and C compiler

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3.2.3 BLAS and LAPACK libraries

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3.2.4 MPICH libraries

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3.2.5 HDF5 libraries

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3.2.6 PETSc libraries

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3.2.7 ANISOFLOW

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3.3 Mac

The following procedures were tested on Mac OS X El Capitan 10.11.5, but you shouldn't have problems with older versions.

3.3.1 Preparing the system

From `App Store` download `xCode`, which is the basic developer tool in Mac OS. Although you don't have to use it to run the program, take care with their updates, because each time `xCode` is updated, is very probable you have to re-install everything which depends of `xCode`.

Once `xCode` is installed is also needed a `Command Line Tool` to the `xCode`. It ca be downloaded from https://developer.apple.com/downloads/index.action/. Make sure `Command Line Tool` is the same version of the `xCode` you have installed.

3.3.2 Fortran and C compiler

http://hpc.sourceforge.net

3.3.3 BLAS and LAPACK libraries

Those libraries are usually installed on Mac OS and you don't have to be worried about.

3.3.4 MPICH libraries

The MPICH libraries can be installed automatically from PETSc, unfortunately, the version of MPICH installed from PETSc is incompatible with hdf5. If you don't want HDF5 libraries go to the PETSc installation section and just add `--download-mpich` in the configuration step.

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3.3.5 HDF5 libraries

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3.3.6 PETSc libraries

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3.3.7 ANISOFLOW

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3.4 Windows

3.4.1 Preparing the system

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3.4.2 Fortran and C compiler

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3.4.3 BLAS and LAPACK libraries

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3.4.4 MPICH libraries

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3.4.5 HDF5 libraries

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3.4.6 PETSc libraries

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3.4.7 ANISOFLOW

Chapter 4

Using ANISOFLOW

Once ANISOFLOW has been installed, it can be executed as any other program on Unix systems; opening a Terminal and typing the name of the program there, then, pressing intro to execute.

```
> ANISOFLOW
```

To give instructions to the program, like input parameters, output directories, solution parameters, and others, is needed to provide options before the word who call the program. For example, to provide a directory of input parameters you have to use an option of a list of options given in the chapter 5, in this case the option is "`-Input_dir`" followed by the directory of yournput parameters.

```
> ANISOFLOW -Input_dir /input_test/
```

Depending on the running options you will use, you have to provide several information to the program as input files. In general are needed a topology, a conductivity field and the boundary conditions. This information have to be provided in formatted documents, for more information about formatted documents supported please review the list of options and their explanation.

4.1 Domain

The calculus domain is a parallelepiped with a structured grid which form also parallelepiped cells within the domain.

4.2 Ordering

Every sequential notation of the cells in the program will have priority toward x-axis, later on y-axis, and finally on z-axis. Therefore, the identification of each cell have the same ordering starting on 1.

Note it is an ordering to have a framework on inputs and outputs, but inside the program, that ordering has to switch to PETSc ordering in the parallel environment, however, as user you have not to be worried about.

Chapter 5

List of options of ANISOFLOW

5.1 Input parameters

-Input_dir
-Input_type_gmtry
-Input_file_gmtry
-Input_type_tplgy
-Input_file_tplgy
-Input_type_cvt
-Input_file_cvt
-Input_file_cvt_by_zones
-Input_type_bc
-Input_file_bc
-Input_type

5.2 Output parameters

-Output_dir
-Output_type_tplgy
-Output_type_cvt
-Output_type_sol
-Output_type

5.3 Run options

-Run_options_scheme
-Run_options_time

5.4 Others

`-Verbose`