

Installing Earth Dynamics Linux/FORTRAN on Windows

SOFTWARE INSTALLATION INSTRUCTIONS FOR THE FORTRAN PROGRAMMES DESCRIBED
IN EARTH DYNAMICS, DEFORMATIONS AND OSCILLATIONS OF THE ROTATING EARTH BY
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1 Introduction

The book Earth Dynamics, Deformations and Oscillations of the Rotating Earth, by D. E. Smylie, includes a number of programmes that were written in Gnu FORTRAN 77. In order to compile and run these programmes, it is necessary to have a Linux (or Unix) operating system software.

For your convenience, the author included with book's ancillary material a Fedora Linux appliance (virtual machine) that can be loaded by the Oracle Virtual Machine Manager under Windows (and any other operating systems that support the Oracle VirtualBox).

2 Obtaining and Installing the Oracle VirtualBox

The Oracle VM Server for x86 may be downloaded freely from

<http://www.oracle.com/us/technologies/virtualization/oraclevm/overview/index.html>

Follow the instructions provided by Oracle and install the Virtual Machine on your computer.

3 Obtaining and Installing the Earth Dynamics Linux/Fortran distribution

If you have an existing Linux distribution, all you need to do is to download the "tar-ball" archive "EarthDynamicsBook.taz" from the <http://www.cambridge.org/smylie> web site. Extract the files into a directory of your choice on your Linux computer. A full description of the content of the archive, together with instructions for how to compile and run the programmes, is provided in the file "README.txt" that is also located on the Cambridge web site. The "README.txt" file's text is also reproduced at the end of these Earth Dynamics Linux/FORTRAN system installation instructions.

If you do not have an existing Linux distribution, and wish to run the Fedora Linux installation that was prepared by the author then simply download the Fedora Linux Appliance "FedoraEarthDynamics.ova" from the <http://www.cambridge.org/smylie> web site.

WARNING: The size of the “FedoraEarthDynamics.ova” file is approximately 8GB. It may take a few hours to download over slow internet connections.

Import the appliance into the Oracle VirtualBox environment and start fedora. For more information on the process please consult the online manual at <http://www.virtualbox.org/manual/ch01.html>.

For best result it is recommended that you allocate at least 1GB of memory to the operating system and 64MB of memory to video.

Once the Earth Dynamics Fedora operating system starts you will be presented with a logon screen. Simply click on the “Earth Dynamics” user. No password is necessary. Start a terminal console then type (only the text in **bold** letters):

```
$ cd Book
```

followed by a carriage return.

4 README.txt

Installing, compiling and running the FORTRAN programmes that are described in the book.

a) Extracting the compressed tar archive into your Linux preferred folder

This step is necessary only if you intend to run the FORTRAN software on your own Linux distribution. Note that the FORTRAN source code is already installed on the author’s supplied Linux appliance.

```
$ tar -xvzf EarthDynamicsBook.taz
```

The '\$' character above represents the Linux command line prompt. The above command will create the following directory structure:

```
./Book/Fortran/  
    source/  
    bin/  
    data/  
    example/  
    lib/  
    test/  
    scripts/
```

where,

- The folder 'Book/' contains this 'README.TXT' file.
- The folder 'Fortran/' contains the 'Makefile' that should be used to compile the source code.

- The folder 'Book/Fortran/source/' contains all the FORTRAN source code that is needed to compile all the programmes listed in the book.
- The folder 'Book/Fortran/data/' contains all needed referenced data files.
- The folder 'Book/Fortran/lib/' contains all the subroutines and Functions that are described in the book. These are provided for your reference only. The source programme files (*.for) that were provided in the source folder have these library functions and subroutines already included.
- The folder 'Book/Fortran/bin' contains the executable programmes produced from the compilation of the FORTRAN source code.
- The folder 'Book/Fortran/test/' is for you to test the 'icfs' programme.
- The folder 'Book/Fortran/example/' contains sample output files that were produced by the 'icfs' programme.
- The folder 'Book/Fortran/scripts/' contains a copy of the shell script 'f77gplot'.

b) Compiling all the FORTRAN source files

This requires that your Linux installation includes the G77 (Gnu FORTRAN) compiler. Should you wish to compile the source code (e.g. after you edit it) execute the following commands.

```
$ cd Book/Fortran
$ make
```

The output resulting from the above command sequence should look like:

```
g77 -o bin/decomp source/decomp.for
g77 -o bin/figure source/figure.for
g77 -o bin/icfs source/icfs.for
g77 -o bin/intpspec source/intpspec.for
g77 -o bin/love source/love.for
g77 -o bin/memspec source/memspec.for
g77 -o bin/nutres source/nutres.for
g77 -o bin/poincare source/poincare.for
g77 -o bin/pp2009a source/pp2009a.for
g77 -o bin/ppcy2009a source/ppcy2009a.for
g77 -o bin/ppintp source/ppintp.for source/caldata.for
g77 -o bin/svddft source/svddft.for
g77 -o bin/torque source/torque.for
```

If you are running the Fedora Virtual Box appliance that is available from <http://www.cambridge.org/smylie>, then you can run the programmes. Otherwise, if you use your own Linux distribution, you will need to set your execution path so that it includes the folder 'Book/Fortran/bin/'.

Setting the PATH may be accomplished by adding the following commands to your BASH SHELL start-up script (to the file '.bashrc' that is located in your home directory).

```
# .bashrc
# Source global definitions
if [ -f /etc/bashrc ]; then
    . /etc/bashrc
fi
# User specific aliases and functions
if [ -z "$BOOK_PATH_DEFINED" ]; then
    export BOOK_PATH_DEFINED=".:$HOME/Book/Fortran/bin"
    export PATH="$BOOK_PATH_DEFINED:$PATH"
fi
```

c) Testing your installation

This requires that your Linux installation includes the G77 (Gnu FORTRAN) compiler and the PATH environment variable is properly set (see step b above).

Lines beginning with a '\$' represent your command or input. Do not type the '\$' symbol. All other lines represent the programme prompts.

```
$ cd <your extraction folder of the book files>
$ cd Book/Fortran/test
$ icfs
```

```
Type in Earth model file name.
../data/cal8.dat
```

```
Enter period in hours, azimuthal number and inertial and
Coriolis switches
(1 for in, 0 for out).
4.0 1 1 1
```

```
BOLT AND UHRHAMMER MODEL CAL8
```

Radius (km)	Rho (gm/cc)	Lambda (kbars)	Mu (kbars)	Gzero (cm/sec/sec)
0.0	13.58	13912.7	1760.0	0.0
171.0	13.59	13923.0	1761.0	76.0
771.0	13.55	13645.0	1737.0	294.0
971.0	13.49	13310.7	1700.0	368.0
1171.0	13.38	12735.3	1639.0	442.0
1216.0	13.34	12570.7	1625.0	459.0

```
Enter degree N of fundamental solutions to be computed
1
```

```
$ ls
fs1.dat fs2.dat fs3.dat fsolns.dat
```

You can compare your result files ('fs1.dat', 'fs2.dat', 'fs3.dat' and 'fsolns.dat') against the sample files found in the 'Book/Fortran/example/' folder.

d) Compiling with f77gplot

The script 'f77gplot' is installed for your convenience as '/usr/local/bin/f77gplot' and it is accessible to you from the command line as follows:

```
$ f77gplot -o <outfile> <file-1> [<file-2> ... <file-n>]
```

Where *<outfile>* could be replaced with the location of the target executable, and *<file-1>*, *<file-2> ... <file-n>* are the file names of the FORTRAN source code files that need to be compiled. The brackets '[' and ']' should not be typed in. They are used to the placement of optional programme file names.

For example, assume you have the FORTRAN source code file 'eigens.for' then you may execute the following command to produce the run-time executable 'eigens' in the 'Book/Fortran/bin' folder.

```
$ cd <location of the eigens.for programme>
$ f77gplot eigens.for -o <location of book files>/Book/Fortran/bin/eigens
```

and then to run the eigens programme execute the following command:

```
$ eigens
```