

TOUGH
Training Courses



Code Installation

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Compiling Source Code

- Source code for TOUGH2 v2.1 consists of FORTRAN files, such as *t2cg22.f*, *meshm.f*, *t2f.f*, *t2fm.f*, *t2solv.f*, and *eosX.f* (one of the equation-of-state modules)
- Dimension major arrays in file *T2*
- May need to adjust machine-dependent subroutines (e.g., CPU-time)
- May need to rename duplicate subroutines (see *read.me* file)
- Compile source files to create EOS-specific executable (e.g., *xt2_eosX.exe*) that links core and EOS module (*eosX.o*)

Excerpt from T2

```
C*****
C*****  file 'T2' for module t2cg22.f of TOUGH2, Version 2.1  *****
C*****
C*
C*      ASSIGN PARAMETERS FOR FLEXIBLE DIMENSIONING OF LARGE ARRAYS  *
C*
C*****
C
C
C      IMPLICIT DOUBLE PRECISION(A-H,O-Z)
C
C
C---  MNEL: Number of elements
      PARAMETER (MNEL = 12000)
C
C---  MNCON: Number of connections
      PARAMETER (MNCON = 25000)
C
C---  MNEQ: Number of equations per element (# of Primary variables)
      PARAMETER (MNEQ = 4)
C
C---  MNK: Number of components
      PARAMETER (MNK = 3)
C
C---  MNPH: Number of phases which can be present
      PARAMETER (MNPH = 3)
C
C---  MNB: Number of phase-dependent secondary variables
      PARAMETER (MNB = 8)
...

```


Installation for Short Course on PC

- Executables are provided for this short course
 - ***Obtain your own TOUGH2 license!***
1. Copy course material folder from flash drive to a new directory on your hard drive, e.g., `C:\TOUGH2`
 2. Make TOUGH2 available for execution; two options:
 - 2a. Copy the relevant executable to the directory where your input files are (needs to be done for each working directory), *or...*
 - 2b. ...add `C:\TOUGH2\Executables\PC`
to the command search path (needs to be done only once):
 - START → Settings → Control Panel → System → Advanced → Environment Variables
 - Edit “Path” under System variables
 - Add semi-colon and path name at the end of “Variable value”:
`;C:\TOUGH2\Executables\PC`

Running TOUGH on PC

- Open a DOS Command Window:
 - START → Run... → type: **cmd**
- Change to working directory, e.g.:
cd C:\TOUGH2\Exercises\Problem_Tutorial
- Two options:
 1. Copy relevant TOUGH2 executable, e.g., for EOS3 copy file
C:\TOUGH2\Executables\PC\xt2_eos3.exe
to working directory, e.g., to
C:\TOUGH2\Exercises\Problem_Tutorial
 2. Add directory holding the executable to command search path (see previous slide; needs to be done only once).
- Run TOUGH2 from the command line in the DOS Window, redirecting standard input (<) and standard output (>), e.g.:
xt2_eos3.exe < P1a.txt > P1a.out.txt


Installation for Short Course on **MAC**

- Executables are provided for this short course
- ***Obtain your own TOUGH2 license!***
- Copy course material folder from flash drive to a new directory `$HOME/TOUGH2` on your hard drive
- Copy the relevant executable to the directory where your input files are, or...
- ...add `$HOME/TOUGH2/Executables/MAC` to the command search path (for bash shell):
 - open a Terminal ()
 - edit file `~/.bashrc` and add the following line:

```
PATH=$PATH:$HOME/TOUGH2/Executables/MAC
```
 - save file and quite editor
 - type:

```
source ~/.bashrc
```

Running TOUGH on MAC

- Open a Terminal (

```
xt2_eos3.mac < P1a.txt > P1a.out
```

- If you copied the executable to the working directory rather than defining the command search path in file `~/.bashrc` (see previous slide), you may need to add `./`, i.e.:

```
./xt2_eos3.mac < P1a.txt > P1a.out
```

Useful Programs

- Textpad for text editing, file comparison:
<http://www.textpad.com/download/>
- Relative permeability and capillary pressure curves (under Tools):
<http://www.thunderheadeng.com/petrasim/petrasim-resources/#target5>
- Steam table:
<http://www.steamtablesonline.com/steam97web.aspx>
- Thermodynamic properties:
<http://webbook.nist.gov/chemistry/>
- Other TOUGH related free software:
<http://esd.lbl.gov/research/projects/tough/licensing/free.html>