

COMSOL Multiphysics®

Introduction

COMSOL is a powerful environment for modelling and solving various engineering and scientific problems based on partial differential equations. COMSOL is designed to solve coupled or multiphysics phenomena. For many standard engineering problems COMSOL provides add-on products such as electrical, mechanical, fluid flow, and chemical applications.

- Structural Mechanics Module,
- Heat Transfer Module,
- CFD Module,
- Acoustics Module,
- and many others

COMSOL also allows an interface support for equation-based modelling of partial differential equations.

Execution

On the clusters COMSOL is available in the latest stable version. There are two variants of the release:

- **Non commercial** or so called **>EDU variant>**, which can be used for research and educational purposes.
- **Commercial** or so called **COM variant**, which can be used also for commercial activities. **COM variant** has only subset of features compared to the **EDU variant>** available.

More about licensing will be posted here soon.

To load the of COMSOL load the module

```
$ module load COMSOL/51-EDU
```

By default the **EDU variant>** will be loaded. If user needs other version or variant, load the particular version. To obtain the list of available versions use

```
$ module avail COMSOL
```

If user needs to prepare COMSOL jobs in the interactive mode it is recommended to use COMSOL on the compute nodes via PBS Pro scheduler. In order to run the COMSOL Desktop GUI on Windows is recommended to use the Virtual Network Computing (VNC).

```
$ xhost + $ qsub -I -X -A PROJECT_ID -q qprod -l select=1:ppn=24 $
module load COMSOL $ comsol
```

To run COMSOL in batch mode, without the COMSOL Desktop GUI environment, user can utilize the default (comsol.pbs) job script and execute it via the qsub command.

```
' #!/bin/bash #PBS -l select=3:ppn=24 #PBS -q qprod #PBS -N
JOB_NAME #PBS -A PROJECT_ID

cd /scratch/work/user/$USER/ || exit

echo Time is date echo Directory is pwd echo 'PBS_NODEFILESTART*****'
cat $PBS_NODEFILE echo 'PBS_NODEFILEEND*****'

text_nodes < cat $PBS_NODEFILE

module load COMSOL # module load COMSOL/51-EDU

ntask=$(wc -l $PBS_NODEFILE)

comsol -nn ntaskbatch - configuration/tmpmpiargrmkmpiargpbs -
tmpdir/scratch/USER/ -inputfile name_input_f.mph -outputfile name_output_f.mph
-batchlog name_log_f.log '
```

Working directory has to be created before sending the (comsol.pbs) job script into the queue. Input file (name_input_f.mph) has to be in working directory or full path to input file has to be specified. The appropriate path to the temp directory of the job has to be set by command option (-tmpdir).

LiveLink™ for MATLAB®

COMSOL is the software package for the numerical solution of the partial differential equations. LiveLink for MATLAB allows connection to the COMSOL>>® API (Application Programming Interface) with the benefits of the programming language and computing environment of the MATLAB.

LiveLink for MATLAB is available in both **EDU** and **COM variant** of the COMSOL release. On the clusters 1 commercial (>**COM**) license and the 5 educational (>**EDU**) licenses of LiveLink for MATLAB (please see the ISV Licenses) are available. Following example shows how to start COMSOL model from MATLAB via LiveLink in the interactive mode.

```
$ xhost + $ qsub -I -X -A PROJECT_ID -q qexp -l select=1:ppn=24 $
module load MATLAB $ module load COMSOL $ comsol server MATLAB
```

At the first time to launch the LiveLink for MATLAB (client-MATLAB/server-COMSOL connection) the login and password is requested and this information is not requested again.

To run LiveLink for MATLAB in batch mode with (comsol_matlab.pbs) job script you can utilize/modify the following script and execute it via the qsub command.

```
' #!/bin/bash #PBS -l select=3:ppn=24 #PBS -q qprod #PBS -N
JOB_NAME #PBS -A PROJECT_ID

cd /scratch/work/user/$USER || exit

echo Time is date echo Directory is pwd echo 'PBS_NODEFILESTART*****'
cat $PBS_NODEFILE echo 'PBS_NODEFILEEND*****'

text_nodes < cat $PBS_NODEFILE

module load MATLAB module load COMSOL/51-EDU

ntask=$(wc -l $PBS_NODEFILE)

comsol -nn ntaskserver - configuration/tmp - mpiarg - rmk - mpiargpbs -
tmpdir/scratch/work/user/USER/work & cd /apps/cae/COMSOL/51/mli
matlab -nodesktop -nosplash -r "mphstart; addpath /scratch/work/user/$USER/work;
test_job" '
```

This example shows how to run Livelink for MATLAB with following configuration: 3 nodes and 16 cores per node. Working directory has to be created before submitting (comsol_matlab.pbs) job script into the queue. Input file (test_job.m) has to be in working directory or full path to input file has to be specified. The Matlab command option (-r "mphstart") created a connection with a COMSOL server using the default port number.