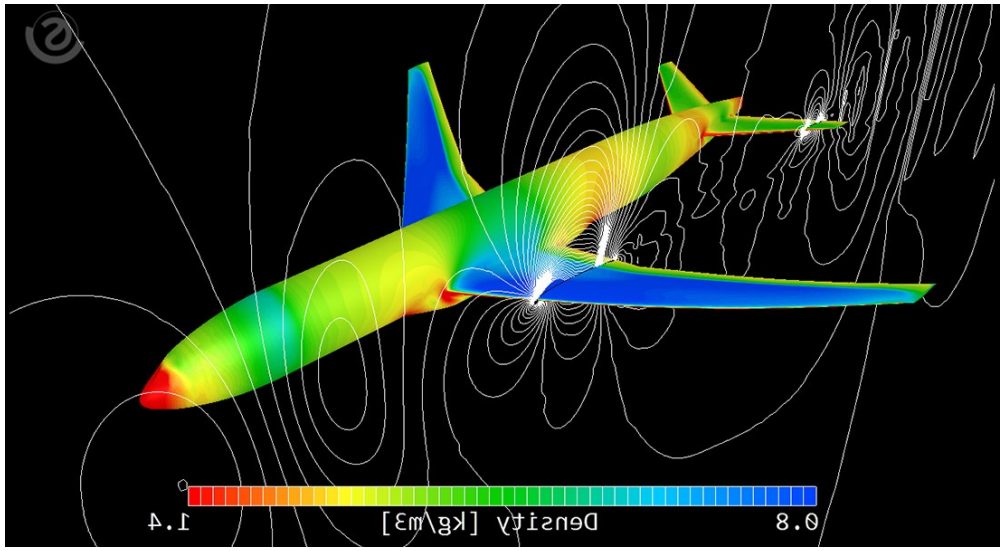
scFlow

A comprehensive Computational Fluid Dynamics (CFD) Package

scFLOW (cradle-cfd.com) is a CFD simulation software suite, having all the three essential modules:

1. Grid generation (Preprocessing).
2. CFD Solvers (Solver).
3. Visualization (Postprocessing).



capable of simulating steady/unsteady flows from incompressible to hypersonic flows over complex geometries, using general polyhedral grids. An ODU adjunct has been contributing to its development since 2011. scFlow is one of the state-of-the-art unstructured-grid solvers, incorporating very recent advances in CFD algorithms.

scFlow is available at ODU

- 20 licenses to perform pre/post-processing and run the solver in the engineering virtual desktop.
- 3 licenses to perform large-scale simulations in the clusters (Turing/Wahab) with an ***unlimited*** # of processors.

These are much more than academic licenses and allow us to perform practical simulations including large-eddy-simulations over complex geometries.

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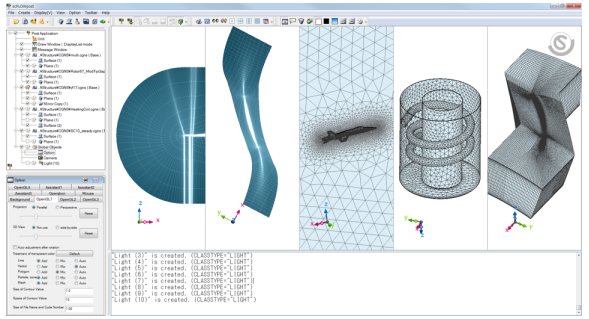
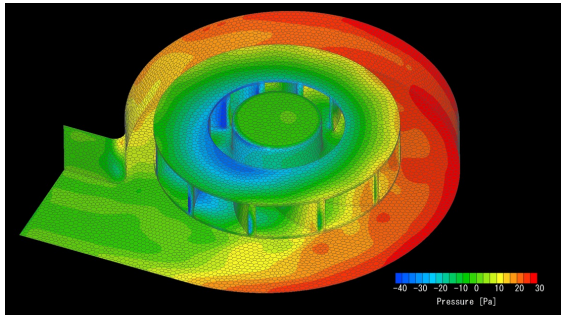
scFLOW Preprocessor

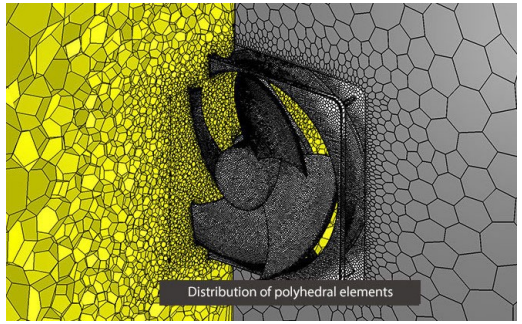
- Modifying/importing CAD data.
- Polyhedral mesher (grid generation).

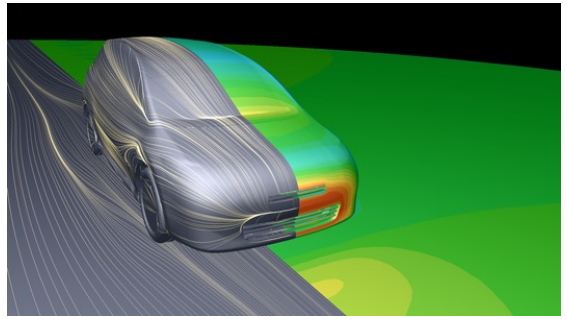




scFLOW Solver

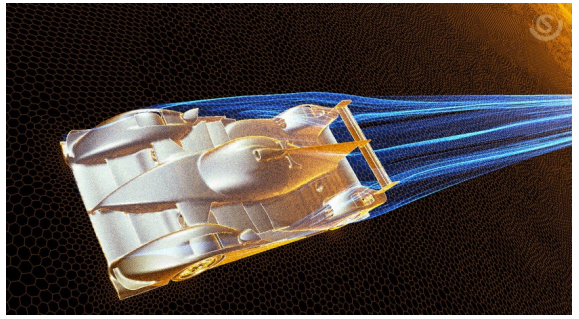
- Incompressible/compressible-flow solvers.
- Particle tracking, moving objects.
- Radiation, cavitation, free surface

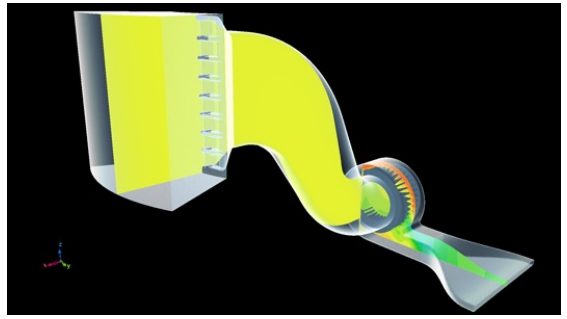




scFLOW Postprocessor

- Contour plots, streamlines, animations.

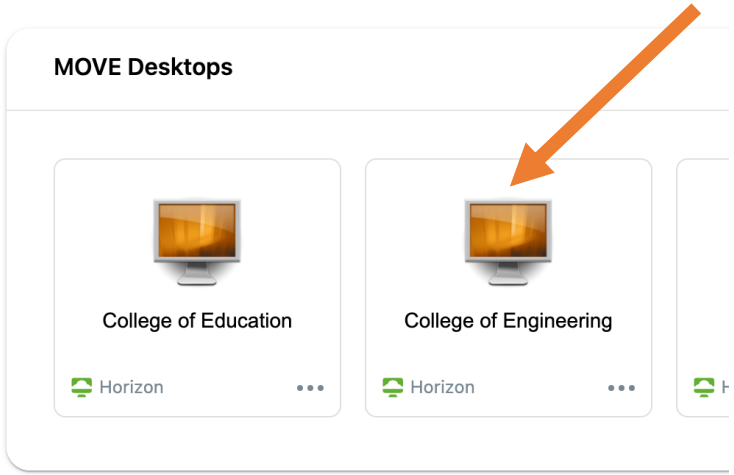




scFlow at ODU

scFlow is available at **MOVE Desktops** (College of Engineering).

http://move.odu.edu



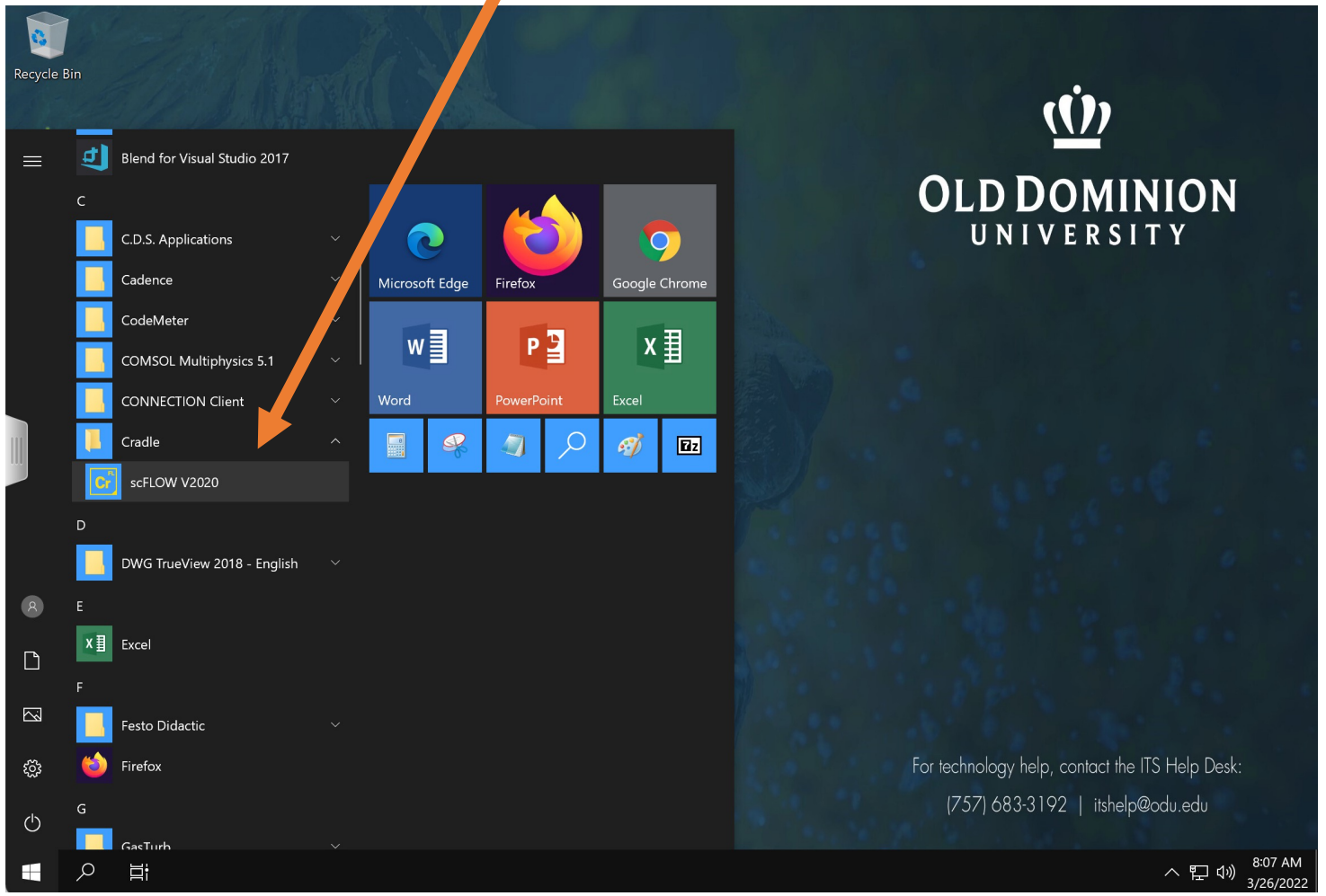
scFlow is available also at **ODU clusters (Turing, Wahab)** for running the solver with an unlimited # of processors.

High Performance Computing - Old Dominion University (odu.edu)

Typically, one would generate a grid and set up parameters in the virtual desktop, run the solver at a cluster, and visualize the result in the virtual desktop.

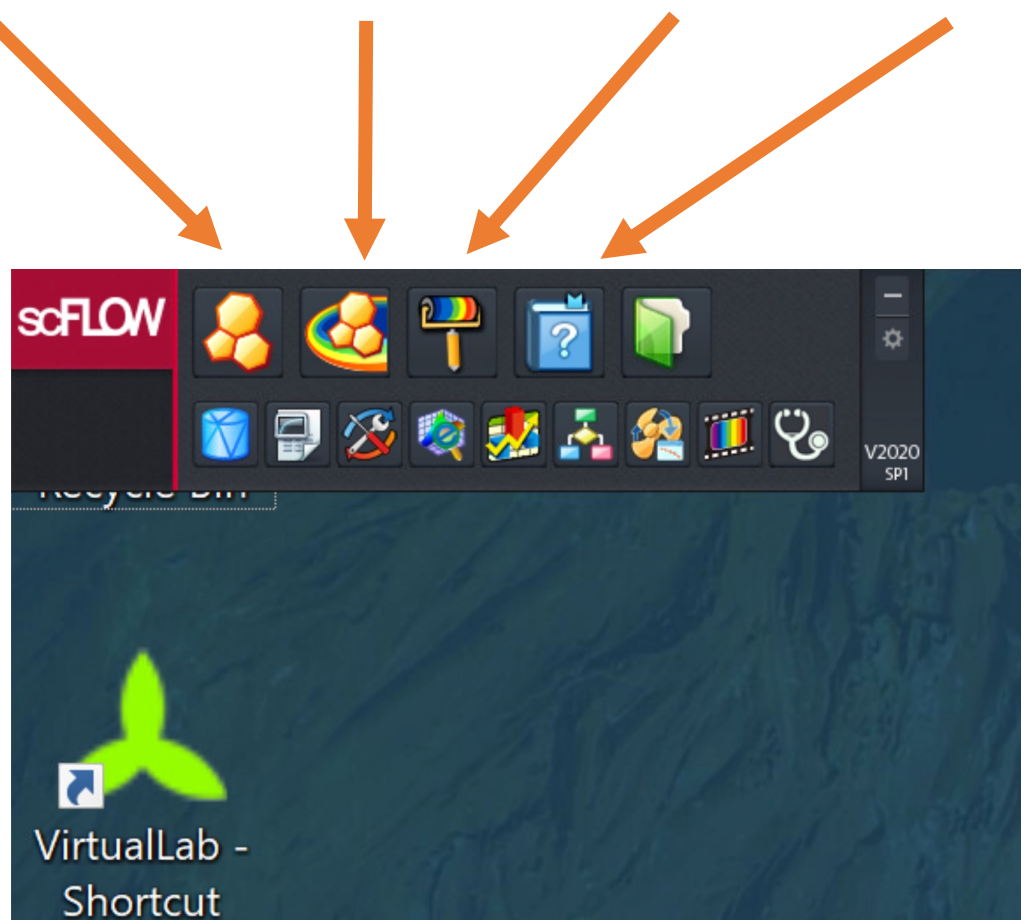
scFlow at Virtual Desktop

scFlow can be found in the application menu.

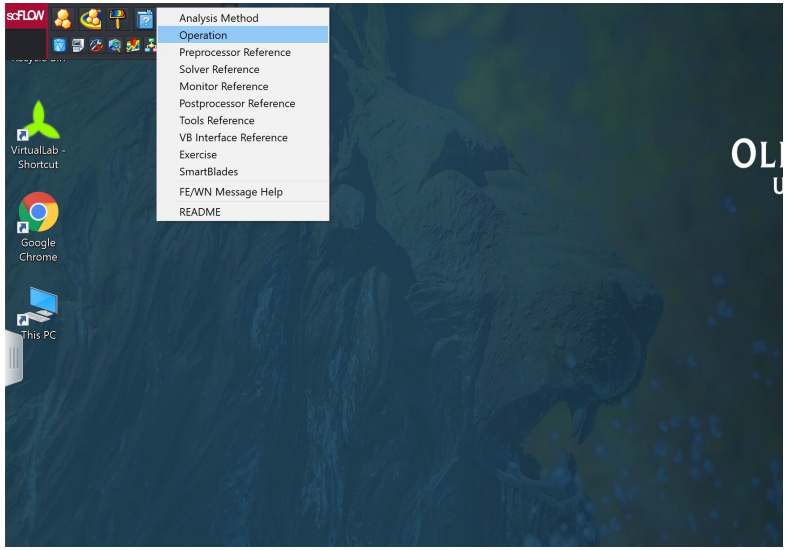


scFlow at Virtual Desktop

Preprocessor Solver Postprocessor



User's guide: -> Operation



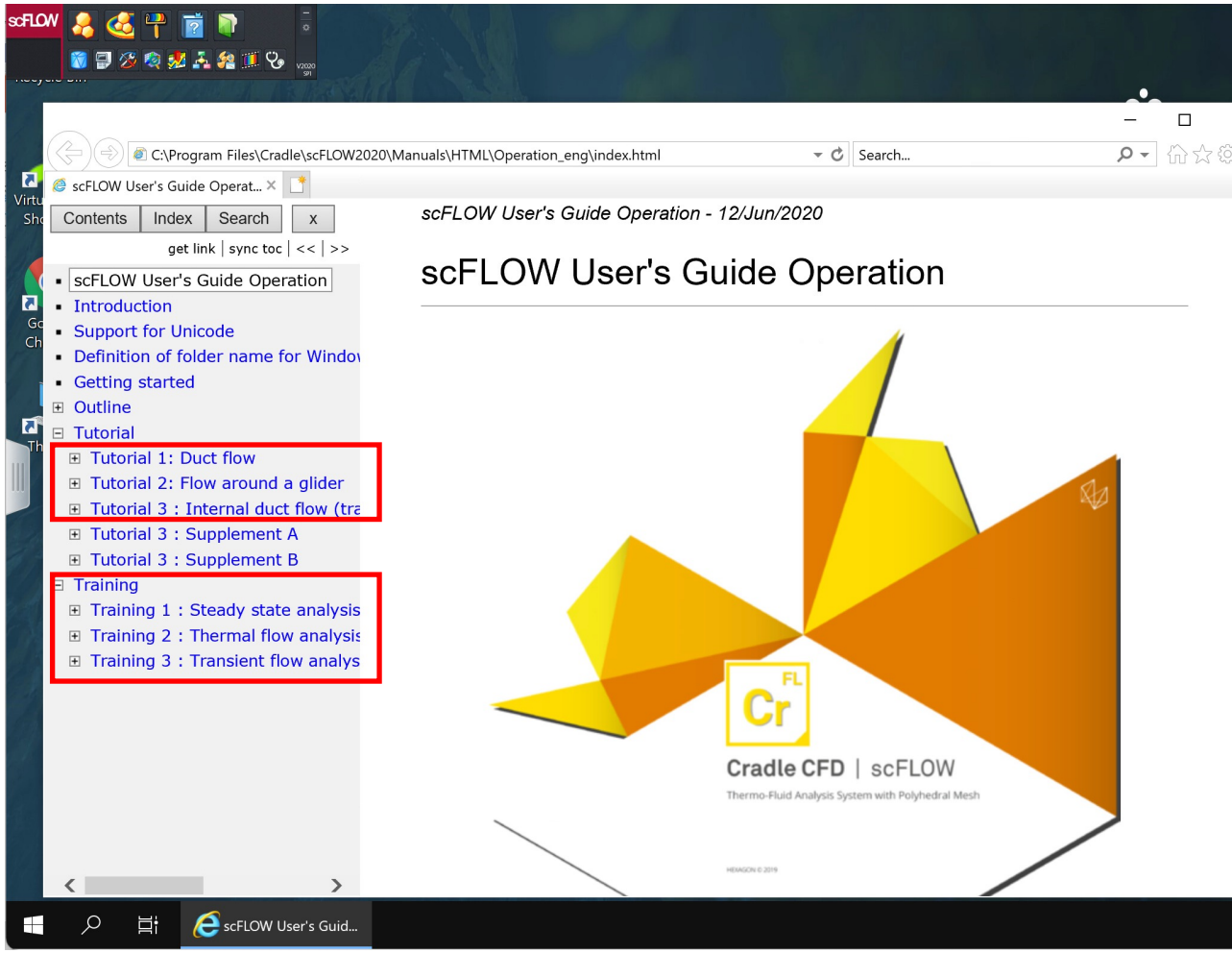
See next page.

Learning scFlow Basics

User's guide: -> Operation, and User's guide will appear.

It is recommended that a beginner completes the first three tutorials to learn the basics of scFlow.

Then, try the three training materials to learn further.



Many users successfully master the basic operations of scFlow in this way.

Further training materials can be found online explained on page 10 of this presentation file.

scFlow in Clusters

scFLow can be run in clusters with an unlimited # of processors. Here is an example using Tutorial 1.

1. Generate a grid and a simulation setting in the virtual desktop.

   The following two files will be generated when the grid and the setting are saved: tut01.gph and tut01.sph

   tut01.sph is a text file containing input parameters ->

```
[hnishika@turing1 tut01]$ more tut01.sph
SDAT
SCFLOW
 1  0  0  UTF-8
% PreVersion : 5222.20300.20211223
% Date : 2021/12/24 15:28:08
GPH
tut01.gph
FPH
tut01
RPH
tut01
ETCO
tut01
/
ICONO    0
IPHAS    0
/
#
TM_CYCLE
    400
#
TM_CYCLE_PROG
    steady
#
EQUA
```

2. Send these files to your directory in a cluster.
   See [File Transfer | Research Cloud Computing (odu.edu)] to learn how to transfer files to a cluster.

   Upload the files to your directory in a cluster ->

   (In the example on the right, the directory is named as tut01.)

```
drwxrwxrwx 2 hnishika users       54  3月  29 17:30 2022 .
drwxrwxrwx 7 hnishika users      206  3月  29 17:29 2022 ..
-rwxr-xr-x 1 hnishika users 12862307  3月  29 17:30 2022 tut01.gph
-rwxr-xr-x 1 hnishika users     2508  3月  29 17:30 2022 tut01.sph
[hnishika@turing1 tut01]$
```

scFlow in Clusters

3. In the directory, create (using vi, for example) a file named run.sh , where run.sh is a text file as shown below.

Here, we request to run scFlow with 16 processors for the maximum of eight hours.

run.sh

```
#!/bin/bash --login
#
#SBATCH -J tut01_16
#
# number of cores to use
#SBATCH -n 16
#SBATCH -t 8:00:00

enable_lmod
module load container_env cradle-cfd/2022p4
crun scflowsol -mscseat_unlimited -lfilename tut01.l tut01.sph $SLURM_NTASKS
```

4. Submit a job by typing in a terminal: sbatch run.sh

You can see how the solver is running in the file
slurm-xxxx.out
where xxxx is the job number (9734382 in the example).
Check the status by the command:
squeue -u [user name]
See the example on the right.

```
[hnishika@turing1 tut01]$ sbatch run.sh
Submitted batch job 9734382
[hnishika@turing1 tut01]$ squeue -u hnishika
             JOBID PARTITION     NAME     USER ST       TIME  NODES NODELIST(REASON)
           9734382      main tut01_16 hnishika  R       0:02      1 coreV2-22-016
[hnishika@turing1 tut01]$ ls -l
合計 11000
-rwxr-xr-x 1 hnishika users      244  3月 29 17:37 2022 run.sh
-rwxrwxrwx 1 hnishika users     1073  3月 29 18:22 2022 slurm-9734382.out
-rwxrwxrwx 1 hnishika users        0  3月 29 18:22 2022 tut01.ccdt
-rwxrwxrwx 1 hnishika users      353  3月 29 18:22 2022 tut01.csln
-rwxr-xr-x 1 hnishika users 12862307  3月 29 17:30 2022 tut01.gph
-rwxrwxrwx 1 hnishika users      563  3月 29 18:22 2022 tut01.l
-rwxr-xr-x 1 hnishika users     2508  3月 29 17:30 2022 tut01.sph
-rwxrwxrwx 1 hnishika users       28  3月 29 18:22 2022 tut01.sph.activity
```

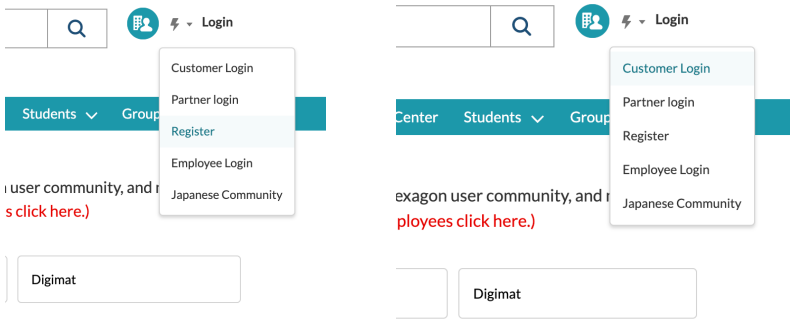
See [Slurm Job Scheduler | Research Cloud Computing (odu.edu)] for further information about how to submit a job in clusters.

4. Transfer the result (tut_01.fph) to the virtual desktop and visualize the result.

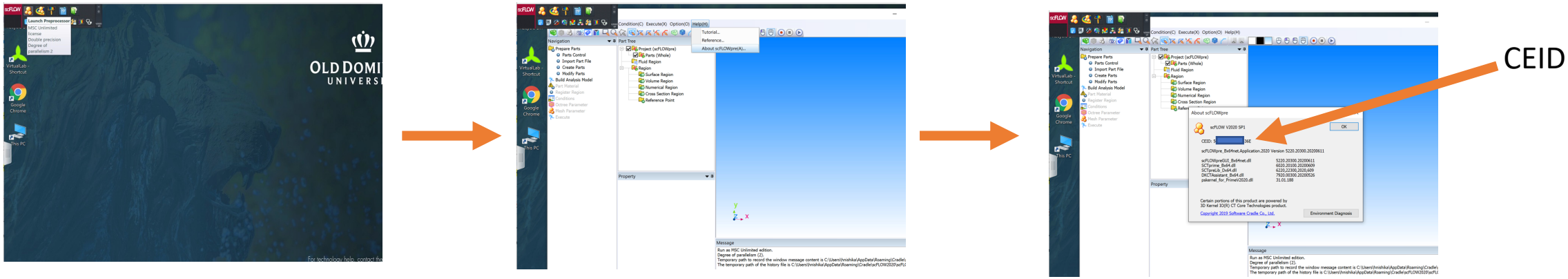
scFlow training materials and support

Further information and various training materials can be found at https://simcompanion.hexagon.com

Note: you need to register and `customer' login to get access to all materials.



Note: CEID may be needed to `customer' login, which can be found as follows:



You can directly contact Cradle support by e-mail at cradle.support@hexagon.com