BPL_TEST2_Chemostat script with PyFMI ver 2.7.4

The key library PyFMI v2.7.4 is installed and downgrading is done Numpy v1.19.1. To simplify this we first install conda.

After the installation a small application BPL_TEST2_Chemostat is loaded and run. You can continue with this example if you like.

```
!lsb_release -a # Actual VM Ubuntu version used by Google
```

```
No LSB modules are available.
Distributor ID: Ubuntu
Description:    Ubuntu 18.04.6 LTS
Release:        18.04
Codename:       bionic
```

```
%env PYTHONPATH=
```

```
env: PYTHONPATH=
```

```
!wget https://repo.anaconda.com/miniconda/Miniconda3-py37_4.12.0-Linux-x86_64.sh
!chmod +x Miniconda3-py37_4.12.0-Linux-x86_64.sh
!bash ./Miniconda3-py37_4.12.0-Linux-x86_64.sh -b -f -p /usr/local
import sys
sys.path.append('/usr/local/lib/python3.7/site-packages/')
```

```
--2022-10-18 06:12:30--  https://repo.anaconda.com/miniconda/Miniconda3-py37_4
Resolving repo.anaconda.com (repo.anaconda.com)... 104.16.130.3, 104.16.131.3,
Connecting to repo.anaconda.com (repo.anaconda.com)|104.16.130.3|:443... conne
HTTP request sent, awaiting response... 200 OK
Length: 104996770 (100M) [application/x-sh]
Saving to: ‘Miniconda3-py37_4.12.0-Linux-x86_64.sh’

Miniconda3-py37_4.1 100%[===================>] 100.13M   131MB/s    in 0.8s

2022-10-18 06:12:31 (131 MB/s) - ‘Miniconda3-py37_4.12.0-Linux-x86_64.sh’ save

PREFIX=/usr/local
Unpacking payload ...
Collecting package metadata (current_repodata.json): done
Solving environment: failed with initial frozen solve. Retrying with flexible
Solving environment: failed with repodata from current_repodata.json, will ret
Collecting package metadata (repodata.json): done
Solving environment: failed with initial frozen solve. Retrying with flexible
Solving environment: /
Found conflicts! Looking for incompatible packages.
This can take several minutes.  Press CTRL-C to abortfailed

UnsatisfiableError: The following specifications were found to be incompatible

Output in format: Requested package -> Available versions
```

```
  Package libgcc-ng conflicts for:
  setuptools==61.2.0=py37h06a4308_0 -> python[version='>=3.7,<3.8.0a0'] -> libgc
  conda-package-handling==1.8.1=py37h7f8727e_0 -> libgcc-ng[version='>=7.5.0']
  numpy -> libgcc-ng[version='>=10.3.0|>=7.3.0']
  python==3.7.13=h12debd9_0 -> libgcc-ng[version='>=7.5.0']
  cffi==1.15.0=py37hd667e15_1 -> libffi[version='>=3.3'] -> libgcc-ng[version='>
  assimulo -> libgcc-ng[version='>=9.4.0']
  scipy -> numpy[version='>=1.18.5,<2.0a0'] -> libgcc-ng[version='>=10.3.0|>=7.3
  tbb -> libgcc-ng[version='>=10.3.0']
  readline==8.1.2=h7f8727e_1 -> ncurses[version='>=6.3,<7.0a0'] -> libgcc-ng[ver
  libiconv -> libgcc-ng[version='>=10.3.0']
  pyfmi -> assimulo[version='>=3.0'] -> libgcc-ng[version='>=10.3.0|>=9.4.0|>=7.
  ruamel_yaml==0.15.100=py37h27cfd23_0 -> python[version='>=3.7,<3.8.0a0'] -> li
  lxml -> libxml2[version='>=2.9.10,<2.11.0a0'] -> libgcc-ng[version='>=7.5.0|>=
  yaml==0.2.5=h7b6447c_0 -> libgcc-ng[version='>=7.3.0']
  pycosat==0.6.3=py37h27cfd23_0 -> python[version='>=3.7,<3.8.0a0'] -> libgcc-ng
  ncurses==6.3=h7f8727e_2 -> libgcc-ng[version='>=7.5.0']
  openssl==1.1.1n=h7f8727e_0 -> libgcc-ng[version='>=7.5.0']
  icu -> libgcc-ng[version='>=9.4.0']
  cryptography==36.0.0=py37h9ce1e76_0 -> cffi[version='>=1.12'] -> libgcc-ng[ver
  libopenblas -> libgcc-ng[version='>=10.3.0']
  pyfmi -> libgcc-ng[version='>=7.5.0']
  pip==21.2.2=py37h06a4308_0 -> python[version='>=3.7,<3.8.0a0'] -> libgcc-ng[ve
  pycparser==2.21=pyhd3eb1b0_0 -> python[version='>=3.6'] -> libgcc-ng[version='
  suitesparse -> metis[version='>=5.1.0,<5.2.0a0'] -> libgcc-ng[version='>=10.3.
  toolz -> python[version='>=3.5'] -> libgcc-ng[version='>=7.5.0']
  sqlite==3.38.2=hc218d9a_0 -> zlib[version='>=1.2.11,<1.3.0a0'] -> libgcc-ng[ve
  sqlite==3.38.2=hc218d9a_0 -> libgcc-ng[version='>=7.5.0']
  libblas -> libopenblas[version='>=0.3.20,<0.3.21.0a0'] -> libgcc-ng[version='>
  libgcc-ng==9.3.0=h5101ec6_17
  conda-content-trust==0.1.1=pyhd3eb1b0_0 -> cryptography -> libgcc-ng[version='
```

```
!conda update -n base -c defaults conda --yes
```

```
  Collecting package metadata (current_repodata.json): done
  Solving environment: done

  ## Package Plan ##

    environment location: /usr/local

    added / updated specs:
      - conda


  The following packages will be SUPERSEDED by a higher-priority channel:

    ca-certificates    conda-forge::ca-certificates-2022.9.2~ --> pkgs/main::ca-
    certifi            conda-forge/noarch::certifi-2022.9.24~ --> pkgs/main/linu
    conda              conda-forge::conda-22.9.0-py37h89c186~ --> pkgs/main::con


  Preparing transaction: done
  Verifying transaction: done
  Executing transaction: done
  Retrieving notices: ...working... done
```

```
!conda --version
```

```
!python --version
```

```
conda 22.9.0
Python 3.7.13
```

```
!conda install -c conda-forge pyfmi==2.7.4 --yes # Install the key package
```

```
Collecting package metadata (current_repodata.json): done
Solving environment: done

## Package Plan ##

  environment location: /usr/local

  added / updated specs:
    - pyfmi==2.7.4


The following packages will be UPDATED:

  ca-certificates    pkgs/main::ca-certificates-2022.07.19~ --> conda-forge::c
  conda              pkgs/main::conda-22.9.0-py37h06a4308_0 --> conda-forge::c

The following packages will be SUPERSEDED by a higher-priority channel:

  certifi            pkgs/main/linux-64::certifi-2022.9.24~ --> conda-forge/nc


Preparing transaction: done
Verifying transaction: done
Executing transaction: done
Retrieving notices: ...working... done
```

```
!conda install numpy=1.19.1 --yes # Need to downgrade numpy
```

```
Collecting package metadata (current_repodata.json): done
Solving environment: failed with initial frozen solve. Retrying with flexible
Collecting package metadata (repodata.json): done
Solving environment: done

## Package Plan ##

  environment location: /usr/local

  added / updated specs:
    - numpy=1.19.1


The following packages will be downloaded:

    package                    |            build
    ---------------------------|-----------------
    blas-1.0                   |         openblas          46 KB
    ------------------------------------------------------------
                                           Total:          46 KB

The following NEW packages will be INSTALLED:
```

```
  blas               pkgs/main/linux-64::blas-1.0-openblas None
  numpy-base         pkgs/main/linux-64::numpy-base-1.19.1-py37h75fe3a5_0 None

The following packages will be SUPERSEDED by a higher-priority channel:

  ca-certificates    conda-forge::ca-certificates-2022.9.2~ --> pkgs/main::ca-
  certifi            conda-forge/noarch::certifi-2022.9.24~ --> pkgs/main/linu
  conda              conda-forge::conda-22.9.0-py37h89c186~ --> pkgs/main::con
  numpy              conda-forge::numpy-1.21.6-py37h976b52~ --> pkgs/main::num



Downloading and Extracting Packages
blas-1.0             | 46 KB     | : 100% 1.0/1 [00:00<00:00, 18.26it/s]

ChecksumMismatchError: Conda detected a mismatch between the expected content
for url 'https://repo.anaconda.com/pkgs/main/linux-64/blas-1.0-openblas.conda'
  download saved to: /usr/local/pkgs/blas-1.0-openblas.conda
  expected sha256: c85b5d0a336b5be0f415c71fd7fe2eca59e09f42221bfa684aafef5510b
  actual sha256: 5dc5483db0d9785b19e021cee418a8ee03e0ff0e5ebd0b75af4927746604e
```

Now specific installation run a simulation and notebook for that

Start with connecting to Github. Then upload the two files:

- FMU - BPL_TEST2_Chemostat_linux_jm_cs.fmu
- Setup-file - BPL_TEST2_Chemostat_explore.py

```
# Filter out DepracationWarnings for 'np.float as alias' is needed - wish I could m
import warnings
warnings.filterwarnings("ignore")
```

```
%%bash
git clone https://github.com/janpeter19/BPL_TEST2_Chemostat
```

```
Cloning into 'BPL_TEST2_Chemostat'...
```

```
%cd BPL_TEST2_Chemostat
```

```
/content/BPL_TEST2_Chemostat/BPL_TEST2_Chemostat/BPL_TEST2_Chemostat/BPL_TEST2
```

```
run -i BPL_TEST2_Chemostat_explore.py
```

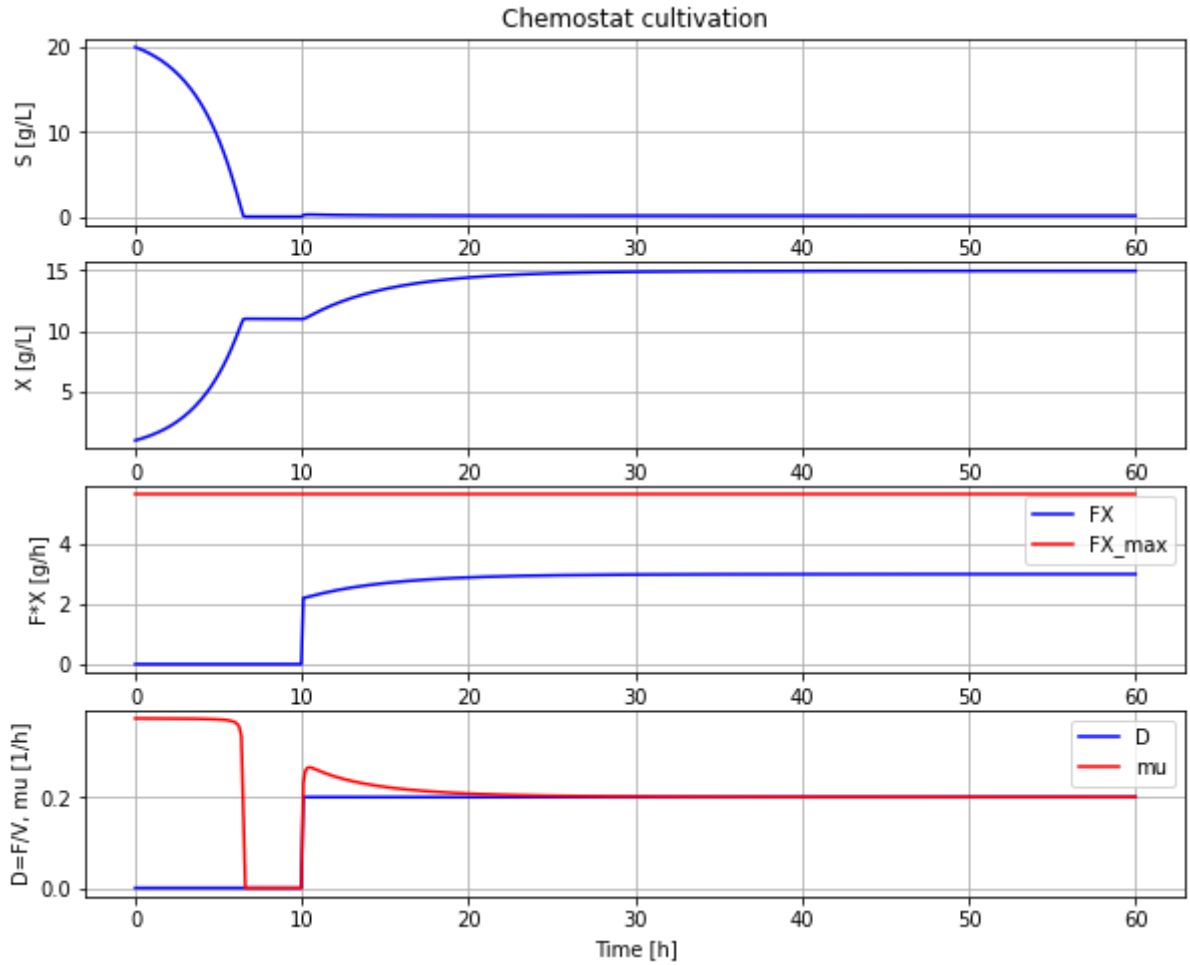
```
Linux - run FMU pre-compiled JModelica 2.4

Model for bioreactor has been setup. Key commands:
 - par()       - change of parameters and initial values
 - init()      - change initial values only
 - simu()      - simulate and plot
 - newplot()   - make a new plot
 - show()      - show plot from previous simulation
```

```
%matplotlib inline
plt.rcParams['figure.figsize'] = [25/2.54, 20/2.54]
```

```
Note that both disp() and describe() takes values from the last simulation
```

```
newplot()
par(Y=0.50, qSmax=0.75,  Ks=0.1)          # Culture parameters
init(V_0=1.0, VX_0=1.0, VS_0=20)          # Bioreactor startup
par(S_in=30, t0=0, F0=0, t1=10, F1=0.2)   # Substrate feeding
simu(60)
```




```
# The maximal biomass productivity FX_max [g/h] marked red in the diagram above
# can be calculated for CSTR from the FMU and is
cstrProdMax(model)
```

```
5.625
```

```
describe('cstrProdMax')
```

```
Calculate from the model maximal chemostat productivity FX_max : 5.625 [ g/h ]
```

```
describe('parts')
```

```
['bioreactor', 'bioreactor.culture', 'D', 'dosagescheme', 'feedtank', 'harvest
```

```
system_info()
```

```
System information
 -OS: Linux
 -Python: 3.7.15
 -Scipy: not installed in the notebook
 -PyFMI: 2.7.4
 -FMU by: JModelica.org
 -FMI: 2.0
 -Type: FMUModelCS2
 -Name: BPL_TEST2.Chemostat
 -Generated: 2022-10-17T11:45:49
 -MSL: 3.2.2 build 3
 -Description: Bioprocess Library version 2.1.0
 -Interaction: FMU-explore version 0.9.5
```