PyFMI ver 2.7.4 installation and then BPL_TEST2_Batch script

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_Batch 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/')
```

```
        runmar_yaml    u.ru.100 py37HZ701aZ0_0
      - setuptools==61.2.0=py37h06a4308_0
      - six==1.16.0=pyhd3eb1b0_1
      - sqlite==3.38.2=hc218d9a_0
      - tk==8.6.11=h1ccaba5_0
      - tqdm==4.63.0=pyhd3eb1b0_0
      - urllib3==1.26.8=pyhd3eb1b0_0
      - wheel==0.37.1=pyhd3eb1b0_0
      - xz==5.2.5=h7b6447c_0
      - yaml==0.2.5=h7b6447c_0
      - zlib==1.2.12=h7f8727e_1


    The following NEW packages will be INSTALLED:

      _libgcc_mutex      pkgs/main/linux-64::_libgcc_mutex-0.1-main
      _openmp_mutex      pkgs/main/linux-64::_openmp_mutex-4.5-1_gnu
      brotlipy           pkgs/main/linux-64::brotlipy-0.7.0-py37h27cfd23_1003
      ca-certificates    pkgs/main/linux-64::ca-certificates-2022.3.29-h06a4308_1
      certifi            pkgs/main/linux-64::certifi-2021.10.8-py37h06a4308_2
      cffi               pkgs/main/linux-64::cffi-1.15.0-py37hd667e15_1
      charset-normalizer pkgs/main/noarch::charset-normalizer-2.0.4-pyhd3eb1b0_0
      colorama           pkgs/main/noarch::colorama-0.4.4-pyhd3eb1b0_0
      conda              pkgs/main/linux-64::conda-4.12.0-py37h06a4308_0
```

```
  conda-content-tru~  pkgs/main/noarch::conda-content-trust-0.1.1-pyhd3eb1b0_0
  conda-package-han~  pkgs/main/linux-64::conda-package-handling-1.8.1-py37h7f8
  cryptography        pkgs/main/linux-64::cryptography-36.0.0-py37h9ce1e76_0
  idna                pkgs/main/noarch::idna-3.3-pyhd3eb1b0_0
  ld_impl_linux-64    pkgs/main/linux-64::ld_impl_linux-64-2.35.1-h7274673_9
  libffi              pkgs/main/linux-64::libffi-3.3-he6710b0_2
  libgcc-ng           pkgs/main/linux-64::libgcc-ng-9.3.0-h5101ec6_17
  libgomp             pkgs/main/linux-64::libgomp-9.3.0-h5101ec6_17
  libstdcxx-ng        pkgs/main/linux-64::libstdcxx-ng-9.3.0-hd4cf53a_17
  ncurses             pkgs/main/linux-64::ncurses-6.3-h7f8727e_2

  openssl             pkgs/main/linux-64::openssl-1.1.1n-h7f8727e_0
  pip                 pkgs/main/linux-64::pip-21.2.2-py37h06a4308_0
  pycosat             pkgs/main/linux-64::pycosat-0.6.3-py37h27cfd23_0
  pycparser           pkgs/main/noarch::pycparser-2.21-pyhd3eb1b0_0
  pyopenssl           pkgs/main/noarch::pyopenssl-22.0.0-pyhd3eb1b0_0
  pysocks             pkgs/main/linux-64::pysocks-1.7.1-py37_1
  python              pkgs/main/linux-64::python-3.7.13-h12debd9_0
  readline            pkgs/main/linux-64::readline-8.1.2-h7f8727e_1
  requests            pkgs/main/noarch::requests-2.27.1-pyhd3eb1b0_0
  ruamel_yaml         pkgs/main/linux-64::ruamel_yaml-0.15.100-py37h27cfd23_0
  setuptools          pkgs/main/linux-64::setuptools-61.2.0-py37h06a4308_0
  six                 pkgs/main/noarch::six-1.16.0-pyhd3eb1b0_1
  sqlite              pkgs/main/linux-64::sqlite-3.38.2-hc218d9a_0
  tk                  pkgs/main/linux-64::tk-8.6.11-h1ccaba5_0
  tqdm                pkgs/main/noarch::tqdm-4.63.0-pyhd3eb1b0_0
  urllib3             pkgs/main/noarch::urllib3-1.26.8-pyhd3eb1b0_0
  wheel               pkgs/main/noarch::wheel-0.37.1-pyhd3eb1b0_0
  xz                  pkgs/main/linux-64::xz-5.2.5-h7b6447c_0
  yaml                pkgs/main/linux-64::yaml-0.2.5-h7b6447c_0
  zlib                pkgs/main/linux-64::zlib-1.2.12-h7f8727e_1


  Preparing transaction: done
  Executing transaction: done
  installation finished.


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

  colorama-0.4.4-pyhd3eb1b0_0
  conda-content-trust-0.1.1-pyhd3eb1b0_0
  six-1.16.0-pyhd3eb1b0_1

The following packages will be UPDATED:

  _openmp_mutex                                 4.5-1_gnu --> 5.1-1_gnu
  ca-certificates                2022.3.29-h06a4308_1 --> 2022.07.19-h06
  certifi                    2021.10.8-py37h06a4308_2 --> 2022.9.24-py37
  cffi                          1.15.0-py37hd667e15_1 --> 1.15.1-py37h74
  conda                        4.12.0-py37h06a4308_0 --> 22.9.0-py37h06
  conda-package-han~            1.8.1-py37h7f8727e_0 --> 1.9.0-py37h5ee
  cryptography                 36.0.0-py37h9ce1e76_0 --> 37.0.1-py37h9c
  ld_impl_linux-64              2.35.1-h7274673_9 --> 2.38-h1181459_
  libgcc-ng                       9.3.0-h5101ec6_17 --> 11.2.0-h123456
  libgomp                         9.3.0-h5101ec6_17 --> 11.2.0-h123456
  libstdcxx-ng                    9.3.0-hd4cf53a_17 --> 11.2.0-h123456
  ncurses                            6.3-h7f8727e_2 --> 6.3-h5eee18b_3
  openssl                        1.1.1n-h7f8727e_0 --> 1.1.1q-h7f8727
  pip                          21.2.2-py37h06a4308_0 --> 22.2.2-py37h06
  requests          pkgs/main/noarch::requests-2.27.1-pyh~ --> pkgs/main/linu
  setuptools                   61.2.0-py37h06a4308_0 --> 63.4.1-py37h06
```

```
        sqlite                                    3.38.2-hc218d9a_0 --> 3.39.3-h5082229
        tk                                        8.6.11-h1ccaba5_0 --> 8.6.12-h1ccaba
        tqdm              pkgs/main/noarch::tqdm-4.63.0-pyhd3eb~ --> pkgs/main/linu
        urllib3           pkgs/main/noarch::urllib3-1.26.8-pyhd~ --> pkgs/main/linu
        xz                                        5.2.5-h7b6447c_0 --> 5.2.6-h5eee18k
        zlib                                      1.2.12-h7f8727e_1 --> 1.2.12-h5eee18


        Downloading and Extracting Packages
        ca-certificates-2022 | 124 KB     | : 100% 1.0/1 [00:00<00:00,  6.90it/s]
        setuptools-63.4.1    | 1.1 MB     | : 100% 1.0/1 [00:00<00:00,  5.76it/s]
        ld_impl_linux-64-2.3 | 654 KB     | : 100% 1.0/1 [00:00<00:00, 12.57it/s]

        zlib-1.2.12          | 103 KB     | : 100% 1.0/1 [00:00<00:00, 13.56it/s]
        conda-package-handli | 887 KB     | : 100% 1.0/1 [00:00<00:00, 10.96it/s]
        xz-5.2.6             | 394 KB     | : 100% 1.0/1 [00:00<00:00, 11.47it/s]
        libgcc-ng-11.2.0     | 5.3 MB     | : 100% 1.0/1 [00:00<00:00,  4.52it/s]
        cffi-1.15.1          | 227 KB     | : 100% 1.0/1 [00:00<00:00, 14.89it/s]
        certifi-2022.9.24    | 154 KB     | : 100% 1.0/1 [00:00<00:00, 15.87it/s]
        requests-2.28.1      | 92 KB      | : 100% 1.0/1 [00:00<00:00, 15.30it/s]
        libgomp-11.2.0       | 474 KB     | : 100% 1.0/1 [00:00<00:00, 12.82it/s]
        pip-22.2.2           | 2.3 MB     | : 100% 1.0/1 [00:00<00:00,  3.62it/s]
        toolz-0.11.2         | 49 KB      | : 100% 1.0/1 [00:00<00:00, 13.65it/s]
        openssl-1.1.1q       | 2.5 MB     | : 100% 1.0/1 [00:00<00:00,  7.18it/s]
        sqlite-3.39.3        | 1.1 MB     | : 100% 1.0/1 [00:00<00:00, 11.90it/s]
        _openmp_mutex-5.1    | 21 KB      | : 100% 1.0/1 [00:00<00:00, 12.40it/s]
        tk-8.6.12            | 3.0 MB     | : 100% 1.0/1 [00:00<00:00,  5.56it/s]
        conda-22.9.0         | 878 KB     | : 100% 1.0/1 [00:00<00:00,  8.02it/s]
        urllib3-1.26.11      | 181 KB     | : 100% 1.0/1 [00:00<00:00, 13.85it/s]
        libstdcxx-ng-11.2.0  | 4.7 MB     | : 100% 1.0/1 [00:00<00:00,  4.40it/s]
        cryptography-37.0.1  | 1.3 MB     | : 100% 1.0/1 [00:00<00:00,  6.92it/s]
        ncurses-6.3          | 781 KB     | : 100% 1.0/1 [00:00<00:00,  3.41it/s]
        tqdm-4.64.1          | 126 KB     | : 100% 1.0/1 [00:00<00:00, 13.01it/s]
        Preparing transaction: done
        Verifying transaction: done
        Executing transaction: 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

        liblapack           conda-forge/linux-64::liblapack-3.9.0-15_linux64_openblas
        libopenblas         conda-forge/linux-64::libopenblas-0.3.20-pthreads_h78a641
        libxml2             conda-forge/linux-64::libxml2-2.9.12-h72842e0_0 None
        libxslt             conda-forge/linux-64::libxslt-1.1.33-h15afd5d_2 None
        lxml                conda-forge/linux-64::lxml-4.8.0-py37h540881e_2 None
        metis               conda-forge/linux-64::metis-5.1.0-h58526e2_1006 None
        mpfr                conda-forge/linux-64::mpfr-4.1.0-h9202a9a_1 None
        numpy               conda-forge/linux-64::numpy-1.21.6-py37h976b520_0 None
        pyfmi               conda-forge/linux-64::pyfmi-2.7.4-py37h161383b_0 None
        python_abi          conda-forge/linux-64::python_abi-3.7-2_cp37m None
        scipy               conda-forge/linux-64::scipy-1.7.3-py37hf2a6cf1_0 None
        suitesparse         conda-forge/linux-64::suitesparse-5.10.1-h9e50725_1 None
        sundials            conda-forge/linux-64::sundials-5.8.0-h558c624_0 None
        tbb                 conda-forge/linux-64::tbb-2021.5.0-h924138e_1 None
```

```
        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
          openssl               pkgs/main::openssl-1.1.1q-h7f8727e_0 --> conda-forge::c



        Downloading and Extracting Packages
        metis-5.1.0          | 4.1 MB      | : 100% 1.0/1 [00:00<00:00,  1.12it/s]
        fmilib-2.2.3         | 532 KB      | : 100% 1.0/1 [00:00<00:00,  3.66it/s]
        python_abi-3.7       | 4 KB        | : 100% 1.0/1 [00:00<00:00, 19.94it/s]
        numpy-1.21.6         | 6.1 MB      | : 100% 1.0/1 [00:01<00:00,  1.41s/it]
        libopenblas-0.3.20   | 10.1 MB     | : 100% 1.0/1 [00:01<00:00,  1.86s/it]
        assimulo-3.2.9       | 2.6 MB      | : 100% 1.0/1 [00:00<00:00,  1.24it/s]
        libiconv-1.17        | 1.4 MB      | : 100% 1.0/1 [00:00<00:00,  4.21it/s]
        openssl-1.1.1o       | 2.1 MB      | : 100% 1.0/1 [00:00<00:00,  2.47it/s]
        lxml-4.8.0           | 1.4 MB      | : 100% 1.0/1 [00:00<00:00,  3.30it/s]
        libxml2-2.9.12       | 772 KB      | : 100% 1.0/1 [00:00<00:00,  5.69it/s]
        sundials-5.8.0       | 1.0 MB      | : 100% 1.0/1 [00:00<00:00,  1.26it/s]
        libxslt-1.1.33       | 522 KB      | : 100% 1.0/1 [00:00<00:00,  5.52it/s]
        libgfortran-ng-12.1. | 23 KB       | : 100% 1.0/1 [00:00<00:00, 19.37it/s]
        gmp-6.2.1            | 806 KB      | : 100% 1.0/1 [00:00<00:00,  5.06it/s]
        certifi-2022.9.24    | 155 KB      | : 100% 1.0/1 [00:00<00:00, 12.98it/s]
        mpfr-4.1.0           | 2.6 MB      | : 100% 1.0/1 [00:00<00:00,  2.09it/s]
        pyfmi-2.7.4          | 12.4 MB     | : 100% 1.0/1 [00:01<00:00,  1.69s/it]
        tbb-2021.5.0         | 1.9 MB      | : 100% 1.0/1 [00:00<00:00,  2.82it/s]
        liblapack-3.9.0      | 12 KB       | : 100% 1.0/1 [00:00<00:00, 20.44it/s]
        icu-68.2             | 13.1 MB     | : 100% 1.0/1 [00:02<00:00,  2.22s/it]
        conda-22.9.0         | 960 KB      | : 100% 1.0/1 [00:00<00:00,  3.20it/s]
        libcblas-3.9.0       | 12 KB       | : 100% 1.0/1 [00:00<00:00, 21.08it/s]
        scipy-1.7.3          | 21.8 MB     | : 100% 1.0/1 [00:03<00:00,  3.99s/it]
        suitesparse-5.10.1   | 2.4 MB      | : 100% 1.0/1 [00:00<00:00,  2.03it/s]
        libblas-3.9.0        | 12 KB       | : 100% 1.0/1 [00:00<00:00, 20.04it/s]
        libgfortran5-12.1.0  | 1.8 MB      | : 100% 1.0/1 [00:00<00:00,  2.65it/s]
        ca-certificates-2022 | 150 KB      | : 100% 1.0/1 [00:00<00:00, 13.57it/s]
        Preparing transaction: done
        Verifying transaction: done
        Executing transaction: 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
    numpy-1.19.1               |   py37h30dfecb_0             21 KB
    numpy-base-1.19.1          |   py37h75fe3a5_0            4.1 MB
    ------------------------------------------------------------
                                             Total:          4.2 MB

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 UPDATED:

  openssl            conda-forge::openssl-1.1.1o-h166bdaf_0 --> pkgs/main::ope

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
numpy-base-1.19.1    | 4.1 MB    | : 100% 1.0/1 [00:00<00:00,  1.58it/s]
numpy-1.19.1         | 21 KB     | : 100% 1.0/1 [00:00<00:00,  4.46it/s]
blas-1.0             | 46 KB     | : 100% 1.0/1 [00:00<00:00, 12.78it/s]
Preparing transaction: done
Verifying transaction: done
Executing transaction: done
Retrieving notices: ...working... done
```

▾ Now specific installation run a simulation and notebook for that

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

- FMU - BPL_TEST2_Batch_linux_jm_cs.fmu
- Setup-file - BPL_TEST2_Batch_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_Batch
```

```
Cloning into 'BPL_TEST2_Batch'...
```

```
%cd BPL_TEST2_Batch
```

> /content/BPL_TEST2_Batch

```
run -i BPL_TEST2_Batch_explore.py
```

> Linux - run FMU pre-comiled 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
> - disp()   - display parameters and initial values from the last simulatic
> - describe() - describe culture, broth, parameters, variables with values /
>
> Note that both disp() and describe() takes values from the last simulation
>
> Brief information about a command by help(), eg help(simu)
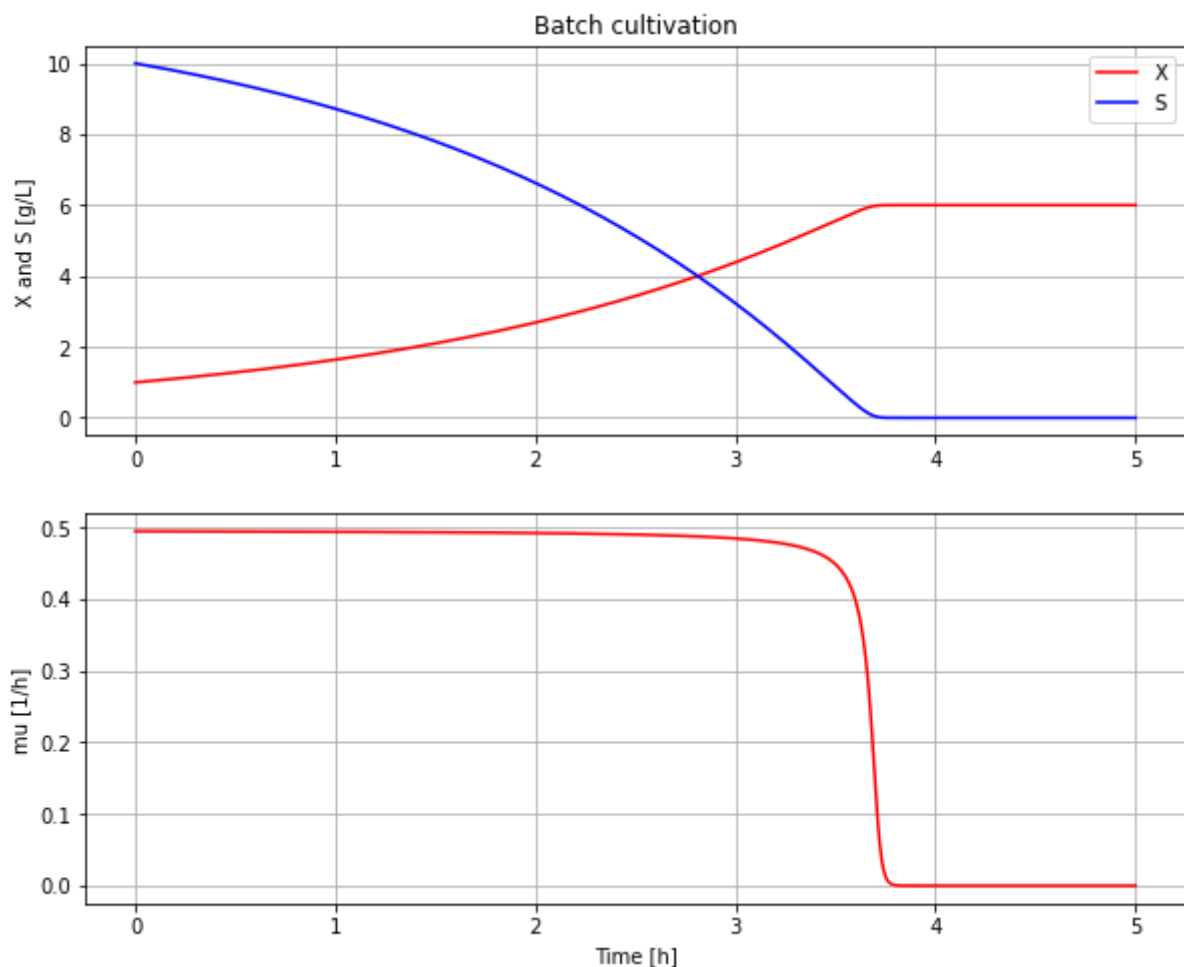> Key system information is listed with the command system_info()

```
%matplotlib inline
plt.rcParams['figure.figsize'] = [25/2.54, 20/2.54]
```
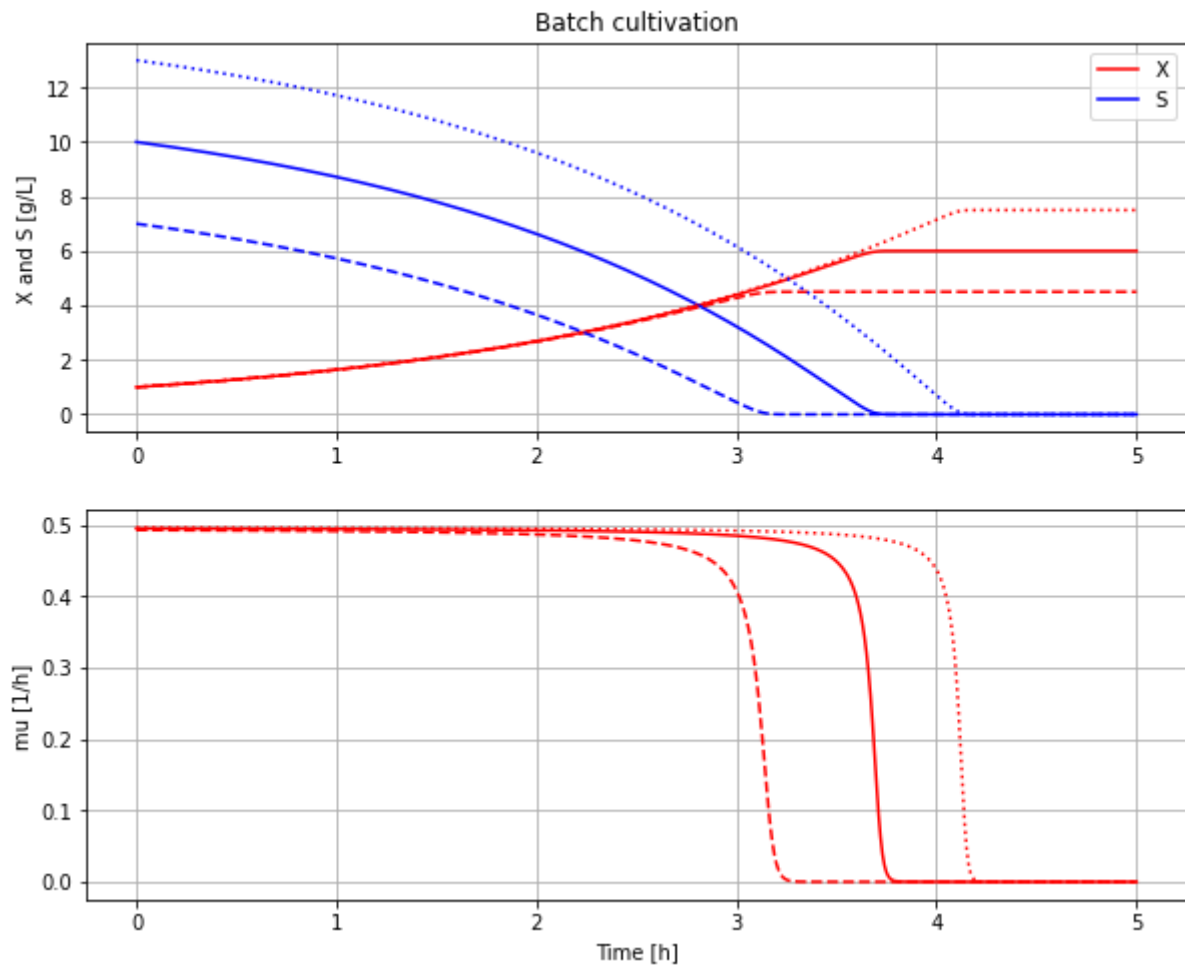
```
# Simulation with default values of the process
newplot(plotType='TimeSeries')
simu()
```

```
# Simulation were initial value of substrate VS_0 is varied
newplot(plotType='TimeSeries')
for value in [10, 7, 13]: init(VS_0=value); simu(5)

# Restore default value of VS_0
init(VS_0=10)
```



```
system_info()
```

```
System information
 -OS: Linux
 -Python: 3.7.14
 -PyFMI: 2.7.4
 -FMU by: JModelica.org
 -FMI: 2.0
 -Type: FMUModelCS2
 -Name: BPL_TEST2.Batch
 -Generated: 2022-05-29T14:24:20
 -Description: Bioprocess Library version 2.0.9
 -Interaction: FMU-explore ver 0.9.1
```

Colab paid products - Cancel contracts here

✓ 0s   completed at 08:44   ● ✕