BPL_TEST2_Fedbatch script with PyFMI

The key library PyFMI is installed.

After the installation a small application BPL_TEST2_Fedbatch is loaded and run. You can continue with this example if you like.

In [1]: `!lsb_release -a # Actual VM Ubuntu version used by Google`

```
No LSB modules are available.
Distributor ID: Ubuntu
Description:    Ubuntu 22.04.4 LTS
Release:        22.04
Codename:       jammy
```

In [2]: `%env PYTHONPATH=`

```
env: PYTHONPATH=
```

In [3]: `!python --version`

```
Python 3.11.11
```

In [4]:
```
!wget https://repo.anaconda.com/miniconda/Miniconda3-py311_24.11.1-0-Linux-x86_64.s
!chmod +x Miniconda3-py311_24.11.1-0-Linux-x86_64.sh
!bash ./Miniconda3-py311_24.11.1-0-Linux-x86_64.sh -b -f -p /usr/local
import sys
sys.path.append('/usr/local/lib/python3.11/site-packages/')
```

```
--2025-03-27 08:43:16--  https://repo.anaconda.com/miniconda/Miniconda3-py311_24.11.
1-0-Linux-x86_64.sh
Resolving repo.anaconda.com (repo.anaconda.com)... 104.16.191.158, 104.16.32.241, 26
06:4700::6810:20f1, ...
Connecting to repo.anaconda.com (repo.anaconda.com)|104.16.191.158|:443... connecte
d.
HTTP request sent, awaiting response... 200 OK
Length: 145900576 (139M) [application/octet-stream]
Saving to: 'Miniconda3-py311_24.11.1-0-Linux-x86_64.sh'

Miniconda3-py311_24 100%[===================>] 139.14M  99.5MB/s    in 1.4s

2025-03-27 08:43:18 (99.5 MB/s) - 'Miniconda3-py311_24.11.1-0-Linux-x86_64.sh' saved
[145900576/145900576]

PREFIX=/usr/local
Unpacking payload ...

Installing base environment...

Preparing transaction: ...working... done
Executing transaction: ...working... done
installation finished.
```

In [5]:
```
!conda update -n base -c defaults conda --yes
```

```
Channels:
 - defaults
Platform: linux-64
Collecting package metadata (repodata.json): - ▒▒\ ▒▒| ▒▒/ ▒▒- ▒▒\ ▒▒| ▒▒/ ▒▒- ▒▒\
▒▒| ▒▒/ ▒▒done
Solving environment: \ ▒▒| ▒▒done

## Package Plan ##

  environment location: /usr/local

  added / updated specs:
    - conda


The following packages will be downloaded:

    package                    |             build
    ---------------------------|-----------------
    ca-certificates-2025.2.25  |       h06a4308_0         129 KB
    certifi-2025.1.31          |   py311h06a4308_0         163 KB
    openssl-3.0.16             |       h5eee18b_0         5.2 MB
    ------------------------------------------------------------
                                           Total:         5.5 MB

The following packages will be UPDATED:

  ca-certificates                      2024.11.26-h06a4308_0 --> 2025.2.25-h06a4308_0
  certifi                          2024.8.30-py311h06a4308_0 --> 2025.1.31-py311h06a4
308_0
  openssl                                  3.0.15-h5eee18b_0 --> 3.0.16-h5eee18b_0



Downloading and Extracting Packages:
openssl-3.0.16       | 5.2 MB    | :   0% 0/1 [00:00<?, ?it/s]
certifi-2025.1.31    | 163 KB    | :   0% 0/1 [00:00<?, ?it/s]

openssl-3.0.16       | 5.2 MB    | :   3% 0.02982593950162064/1 [00:00<00:03,  3.38
s/it]

ca-certificates-2025 | 129 KB    | :  50% 0.49527293063186295/1 [00:00<00:00,  4.92i
t/s]

ca-certificates-2025 | 129 KB    | : 100% 1.0/1 [00:00<00:00,  4.92it/s]
certifi-2025.1.31    | 163 KB    | :  98% 0.9840122040576089/1 [00:00<00:00,  9.06i
t/s]
certifi-2025.1.31    | 163 KB    | : 100% 1.0/1 [00:00<00:00,  9.06it/s]

ca-certificates-2025 | 129 KB    | : 100% 1.0/1 [00:00<00:00,  4.92it/s]


Preparing transaction: - ▒▒done
```

```
    Verifying transaction: | ▯▯/ ▯▯- ▯▯done
    Executing transaction: | ▯▯done
```

In [6]:
```
!conda --version
!python --version
```

```
conda 24.11.1
Python 3.11.11
```

In [7]:
```
!conda config --set channel_priority strict
```

In [8]:
```
!conda install -c conda-forge pyfmi --yes # Install the key package
```

```
Channels:
 - conda-forge
 - defaults
Platform: linux-64
Collecting package metadata (repodata.json): - ▒▒\ ▒▒| ▒▒/ ▒▒- ▒▒\ ▒▒| ▒▒/ ▒▒- ▒▒\
▒▒| ▒▒/ ▒▒- ▒▒\ ▒▒| ▒▒/ ▒▒- ▒▒\ ▒▒| ▒▒/ ▒▒- ▒▒\ ▒▒| ▒▒/ ▒▒- ▒▒\ ▒▒| ▒▒/ ▒▒- ▒▒\ ▒▒|
▒▒/ ▒▒- ▒▒\ ▒▒| ▒▒done
Solving environment: - ▒▒\ ▒▒| ▒▒done

## Package Plan ##

  environment location: /usr/local

  added / updated specs:
    - pyfmi


The following packages will be downloaded:

    package                    |            build
    ---------------------------|-----------------
    _x86_64-microarch-level-3  |      2_broadwell           8 KB  conda-forge
    assimulo-3.6.0             |    py311h083bc19_0         1.1 MB  conda-forge
    certifi-2025.1.31          |      pyhd8ed1ab_0         159 KB  conda-forge
    conda-25.3.0               |    py311h38be061_0         1.1 MB  conda-forge
    fmilib-2.4.1               |        hac33072_1         383 KB  conda-forge
    gmp-6.3.0                  |        hac33072_2         449 KB  conda-forge
    libamd-3.3.3               |  haaf9dc3_7100102          49 KB  conda-forge
    libblas-3.9.0              |31_h59b9bed_openblas         16 KB   conda-forge
    libbtf-2.3.2               |  h32481e8_7100102          27 KB  conda-forge
    libcamd-3.3.3              |  h32481e8_7100102          46 KB  conda-forge
    libcblas-3.9.0             |31_he106b2a_openblas         16 KB   conda-forge
    libccolamd-3.3.4           |  h32481e8_7100102          42 KB  conda-forge
    libcholmod-5.3.1           |  h59ddab4_7100102         1.1 MB  conda-forge
    libcolamd-3.3.4            |  h32481e8_7100102          33 KB  conda-forge
    libcxsparse-4.4.1          |  h32481e8_7100102         118 KB  conda-forge
    libgcc-14.2.0              |        h767d61c_2         828 KB  conda-forge
    libgcc-ng-14.2.0           |        h69a702a_2          52 KB  conda-forge
    libgfortran-14.2.0         |        h69a702a_2          52 KB  conda-forge
    libgfortran-ng-14.2.0      |        h69a702a_2          53 KB  conda-forge
    libgfortran5-14.2.0        |        hf1ad2bd_2         1.4 MB  conda-forge
    libgomp-14.2.0             |        h767d61c_2         449 KB  conda-forge
    libklu-2.3.5               |  hf24d653_7100102         142 KB  conda-forge
    liblapack-3.9.0            |31_h7ac8fdf_openblas         16 KB   conda-forge
    libldl-3.3.2               |  h32481e8_7100102          24 KB  conda-forge
    libopenblas-0.3.29         |pthreads_h94d23a6_0         5.6 MB  conda-forge
    libparu-1.0.0              |  h17147ab_7100102          91 KB  conda-forge
    librbio-4.3.4              |  h32481e8_7100102          47 KB  conda-forge
    libspex-3.2.3              |  had10066_7100102          79 KB  conda-forge
    libspqr-4.3.4              |  h852d39f_7100102         213 KB  conda-forge
    libstdcxx-14.2.0           |        h8f9b012_2         3.7 MB  conda-forge
    libstdcxx-ng-14.2.0        |        h4852527_2          53 KB  conda-forge
    libsuitesparseconfig-7.10.1|  h92d6892_7100102          42 KB  conda-forge
    libumfpack-6.3.5           |  heb53515_7100102         424 KB  conda-forge
    metis-5.1.0                |      hd0bcaf9_1007         3.7 MB  conda-forge
    mpfr-4.2.1                 |        h90cbb55_3         620 KB  conda-forge
```

```
    numpy-2.2.4                |  py311h5d046bc_0         8.6 MB  conda-forge
    openssl-3.4.1              |        h7b32b05_0         2.8 MB  conda-forge
    pyfmi-2.16.3               |  py311h9f3472d_0          5.2 MB  conda-forge
    python_abi-3.11            |          2_cp311            5 KB  conda-forge
    scipy-1.15.2               |  py311h8f841c2_0        16.4 MB  conda-forge
    suitesparse-7.10.1         | ha0f6916_7100102          12 KB  conda-forge
    sundials-7.1.1             |        ha52427a_0        907 KB  conda-forge
    ------------------------------------------------------------
                                           Total:         56.1 MB

The following NEW packages will be INSTALLED:

  _x86_64-microarch~ conda-forge/noarch::_x86_64-microarch-level-3-2_broadwell
  assimulo           conda-forge/linux-64::assimulo-3.6.0-py311h083bc19_0
  fmilib             conda-forge/linux-64::fmilib-2.4.1-hac33072_1
  gmp                conda-forge/linux-64::gmp-6.3.0-hac33072_2
  libamd             conda-forge/linux-64::libamd-3.3.3-haaf9dc3_7100102
  libblas            conda-forge/linux-64::libblas-3.9.0-31_h59b9bed_openblas
  libbtf             conda-forge/linux-64::libbtf-2.3.2-h32481e8_7100102
  libcamd            conda-forge/linux-64::libcamd-3.3.3-h32481e8_7100102
  libcblas           conda-forge/linux-64::libcblas-3.9.0-31_he106b2a_openblas
  libccolamd         conda-forge/linux-64::libccolamd-3.3.4-h32481e8_7100102
  libcholmod         conda-forge/linux-64::libcholmod-5.3.1-h59ddab4_7100102
  libcolamd          conda-forge/linux-64::libcolamd-3.3.4-h32481e8_7100102
  libcxsparse        conda-forge/linux-64::libcxsparse-4.4.1-h32481e8_7100102
  libgcc             conda-forge/linux-64::libgcc-14.2.0-h767d61c_2
  libgfortran        conda-forge/linux-64::libgfortran-14.2.0-h69a702a_2
  libgfortran-ng     conda-forge/linux-64::libgfortran-ng-14.2.0-h69a702a_2
  libgfortran5       conda-forge/linux-64::libgfortran5-14.2.0-hf1ad2bd_2
  libklu             conda-forge/linux-64::libklu-2.3.5-hf24d653_7100102
  liblapack          conda-forge/linux-64::liblapack-3.9.0-31_h7ac8fdf_openblas
  libldl             conda-forge/linux-64::libldl-3.3.2-h32481e8_7100102
  libopenblas        conda-forge/linux-64::libopenblas-0.3.29-pthreads_h94d23a6_0
  libparu            conda-forge/linux-64::libparu-1.0.0-h17147ab_7100102
  librbio            conda-forge/linux-64::librbio-4.3.4-h32481e8_7100102
  libspex            conda-forge/linux-64::libspex-3.2.3-had10066_7100102
  libspqr            conda-forge/linux-64::libspqr-4.3.4-h852d39f_7100102
  libstdcxx          conda-forge/linux-64::libstdcxx-14.2.0-h8f9b012_2
  libsuitesparsecon~ conda-forge/linux-64::libsuitesparseconfig-7.10.1-h92d6892_7100
102
  libumfpack         conda-forge/linux-64::libumfpack-6.3.5-heb53515_7100102
  metis              conda-forge/linux-64::metis-5.1.0-hd0bcaf9_1007
  mpfr               conda-forge/linux-64::mpfr-4.2.1-h90cbb55_3
  numpy              conda-forge/linux-64::numpy-2.2.4-py311h5d046bc_0
  pyfmi              conda-forge/linux-64::pyfmi-2.16.3-py311h9f3472d_0
  python_abi         conda-forge/linux-64::python_abi-3.11-2_cp311
  scipy              conda-forge/linux-64::scipy-1.15.2-py311h8f841c2_0
  suitesparse        conda-forge/linux-64::suitesparse-7.10.1-ha0f6916_7100102
  sundials           conda-forge/linux-64::sundials-7.1.1-ha52427a_0

The following packages will be UPDATED:

  conda              pkgs/main::conda-24.11.1-py311h06a430~ --> conda-forge::conda-2
5.3.0-py311h38be061_0
  libgcc-ng          pkgs/main::libgcc-ng-11.2.0-h1234567_1 --> conda-forge::libgcc-
ng-14.2.0-h69a702a_2
```

```
  libgomp            pkgs/main::libgomp-11.2.0-h1234567_1 --> conda-forge::libgomp
-14.2.0-h767d61c_2
  libstdcxx-ng       pkgs/main::libstdcxx-ng-11.2.0-h12345~ --> conda-forge::libstdc
xx-ng-14.2.0-h4852527_2
  openssl            pkgs/main::openssl-3.0.16-h5eee18b_0 --> conda-forge::openssl
-3.4.1-h7b32b05_0

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

  certifi            pkgs/main/linux-64::certifi-2025.1.31~ --> conda-forge/noarch::
certifi-2025.1.31-pyhd8ed1ab_0



Downloading and Extracting Packages:
scipy-1.15.2         | 16.4 MB   | :    0% 0/1 [00:00<?, ?it/s]
numpy-2.2.4          | 8.6 MB    | :    0% 0/1 [00:00<?, ?it/s]

libopenblas-0.3.29   | 5.6 MB    | :    0% 0/1 [00:00<?, ?it/s]


pyfmi-2.16.3         | 5.2 MB    | :    0% 0/1 [00:00<?, ?it/s]


metis-5.1.0          | 3.7 MB    | :    0% 0/1 [00:00<?, ?it/s]



libstdcxx-14.2.0     | 3.7 MB    | :    0% 0/1 [00:00<?, ?it/s]



openssl-3.4.1        | 2.8 MB    | :    0% 0/1 [00:00<?, ?it/s]




libgfortran5-14.2.0  | 1.4 MB    | :    0% 0/1 [00:00<?, ?it/s]




conda-25.3.0         | 1.1 MB    | :    0% 0/1 [00:00<?, ?it/s]
```

```
assimulo-3.6.0        | 1.1 MB    | :    0% 0/1 [00:00<?, ?it/s]



libcholmod-5.3.1      | 1.1 MB    | :    0% 0/1 [00:00<?, ?it/s]



sundials-7.1.1        | 907 KB    | :    0% 0/1 [00:00<?, ?it/s]



libgcc-14.2.0         | 828 KB    | :    0% 0/1 [00:00<?, ?it/s]



mpfr-4.2.1            | 620 KB    | :    0% 0/1 [00:00<?, ?it/s]
```

```
gmp-6.3.0            | 449 KB    | :    0% 0/1 [00:00<?, ?it/s]




libgomp-14.2.0       | 449 KB    | :    0% 0/1 [00:00<?, ?it/s]




libumfpack-6.3.5     | 424 KB    | :    0% 0/1 [00:00<?, ?it/s]
```

```
fmilib-2.4.1          | 383 KB    | :   0% 0/1 [00:00<?, ?it/s]




libspqr-4.3.4         | 213 KB    | :   0% 0/1 [00:00<?, ?it/s]




  ... (more hidden) ...

libopenblas-0.3.29    | 5.6 MB    | :   0% 0.0027679004637044184/1 [00:00<00:37, 37.4
7s/it]
scipy-1.15.2          | 16.4 MB   | :   0% 0.0019058779654147827/1 [00:00<00:57, 57.4
1s/it]




metis-5.1.0           | 3.7 MB    | :   2% 0.016703198115996697/1 [00:00<00:06,  6.44
s/it]


pyfmi-2.16.3          | 5.2 MB    | :   0% 0.002983953056648666/1 [00:00<00:37, 37.29
s/it]


libopenblas-0.3.29    | 5.6 MB    | :  43% 0.42902457187418486/1 [00:00<00:00,  2.47i
t/s]
scipy-1.15.2          | 16.4 MB   | :  15% 0.15151729825047522/1 [00:00<00:01,  1.18
```

```
s/it]



metis-5.1.0          | 3.7 MB     | :  66% 0.6597763255818695/1 [00:00<00:00,  3.72i
t/s]


pyfmi-2.16.3         | 5.2 MB     | :  48% 0.47743248906378655/1 [00:00<00:00,  2.67i
t/s]
scipy-1.15.2         | 16.4 MB    | :  40% 0.4049990676506413/1 [00:00<00:00,  1.60i
t/s]



metis-5.1.0          | 3.7 MB     | : 100% 1.0/1 [00:00<00:00,  3.72it/s]


pyfmi-2.16.3         | 5.2 MB     | : 100% 1.0/1 [00:00<00:00,  3.03it/s]


pyfmi-2.16.3         | 5.2 MB     | : 100% 1.0/1 [00:00<00:00,  3.03it/s]



libstdcxx-14.2.0     | 3.7 MB     | :   0% 0.0042177278432850495/1 [00:00<01:28, 88.9
8s/it]


libopenblas-0.3.29   | 5.6 MB     | : 100% 1.0/1 [00:00<00:00,  2.69it/s]


scipy-1.15.2         | 16.4 MB    | :  58% 0.579386901486094/1 [00:00<00:00,  1.61it/
s]



openssl-3.4.1        | 2.8 MB     | :   1% 0.00557410490775571376/1 [00:00<01:14, 74.7
9s/it]



libgfortran5-14.2.0  | 1.4 MB     | :   1% 0.011206734985068174/1 [00:00<00:39, 40.10
s/it]



libstdcxx-14.2.0     | 3.7 MB     | :  81% 0.8140214737540146/1 [00:00<00:00,  2.23i
t/s]
```

```
scipy-1.15.2        | 16.4 MB   | :  74% 0.7423394675290579/1 [00:00<00:00,  1.51i
t/s]


openssl-3.4.1       | 2.8 MB    | : 100% 1.0/1 [00:00<00:00,  2.22it/s]


openssl-3.4.1       | 2.8 MB    | : 100% 1.0/1 [00:00<00:00,  2.22it/s]


conda-25.3.0        | 1.1 MB    | :   1% 0.01395284272989957/1 [00:00<00:41, 42.08
s/it]


libstdcxx-14.2.0    | 3.7 MB    | : 100% 1.0/1 [00:00<00:00,  2.23it/s]
numpy-2.2.4         | 8.6 MB    | : 100% 1.0/1 [00:00<00:00,  1.62it/s]
numpy-2.2.4         | 8.6 MB    | : 100% 1.0/1 [00:00<00:00,  1.62it/s]


conda-25.3.0        | 1.1 MB    | : 100% 1.0/1 [00:00<00:00, 42.08s/it]


assimulo-3.6.0      | 1.1 MB    | :   1% 0.014703493605362324/1 [00:00<00:42, 43.11
s/it]
```

```
libcholmod-5.3.1      | 1.1 MB    | :    1% 0.014870549794649543/1 [00:00<00:42, 42.86
s/it]


sundials-7.1.1        | 907 KB    | :    2% 0.01763373830085844/1 [00:00<00:35, 36.25
s/it]


sundials-7.1.1        | 907 KB    | : 100% 1.0/1 [00:00<00:00, 36.25s/it]


libcholmod-5.3.1      | 1.1 MB    | : 100% 1.0/1 [00:00<00:00, 42.86s/it]


assimulo-3.6.0        | 1.1 MB    | : 100% 1.0/1 [00:00<00:00, 43.11s/it]
```

```
mpfr-4.2.1          | 620 KB    | :    3% 0.025811696239942908/1 [00:00<00:27, 27.87
s/it]
```

```
libgcc-14.2.0       | 828 KB    | :    2% 0.019323375221875561/1 [00:00<00:36, 37.46
s/it]
```

```
gmp-6.3.0           | 449 KB    | :    4% 0.03561313321233331/1 [00:00<00:19, 20.47
s/it]
```

```
libgomp-14.2.0      | 449 KB    | :    4% 0.03562807972826631/1 [00:00<00:20, 20.96
s/it]
```

```
gmp-6.3.0              | 449 KB    | : 100% 1.0/1 [00:00<00:00, 20.47s/it]


libumfpack-6.3.5       | 424 KB    | :    4% 0.037731330084655984/1 [00:00<00:21, 21.85
s/it]


libgomp-14.2.0         | 449 KB    | : 100% 1.0/1 [00:00<00:00, 20.96s/it]


mpfr-4.2.1             | 620 KB    | : 100% 1.0/1 [00:00<00:00,  1.61it/s]
```

```
mpfr-4.2.1          | 620 KB    | : 100% 1.0/1 [00:00<00:00,  1.61it/s]

metis-5.1.0         | 3.7 MB    | : 100% 1.0/1 [00:00<00:00,  3.72it/s]

libgcc-14.2.0       | 828 KB    | : 100% 1.0/1 [00:00<00:00,  1.60it/s]

libgcc-14.2.0       | 828 KB    | : 100% 1.0/1 [00:00<00:00,  1.60it/s]

libumfpack-6.3.5    | 424 KB    | : 100% 1.0/1 [00:00<00:00, 21.85s/it]
```

```
fmilib-2.4.1            | 383 KB     | :   4% 0.04180391656566945/1 [00:00<00:20, 21.06
s/it]
```

```
libspqr-4.3.4           | 213 KB     | :   8% 0.07503068271326775/1 [00:00<00:10, 11.75
s/it]
```

```
fmilib-2.4.1            | 383 KB     | : 100% 1.0/1 [00:00<00:00, 21.06s/it]
```

```
libspqr-4.3.4          | 213 KB    | : 100% 1.0/1 [00:00<00:00, 11.75s/it]


pyfmi-2.16.3           | 5.2 MB    | : 100% 1.0/1 [00:00<00:00,  3.03it/s]




 ... (more hidden) ...




scipy-1.15.2           | 16.4 MB   | : 100% 1.0/1 [00:01<00:00,  1.38s/it]
```

```
libgfortran5-14.2.0  | 1.4 MB    | : 100% 1.0/1 [00:01<00:00,  1.13s/it]

libgfortran5-14.2.0  | 1.4 MB    | : 100% 1.0/1 [00:01<00:00,  1.13s/it]

libopenblas-0.3.29   | 5.6 MB    | : 100% 1.0/1 [00:01<00:00,  2.69it/s]

openssl-3.4.1        | 2.8 MB    | : 100% 1.0/1 [00:01<00:00,  2.22it/s]

libstdcxx-14.2.0     | 3.7 MB    | : 100% 1.0/1 [00:01<00:00,  2.23it/s]

conda-25.3.0         | 1.1 MB    | : 100% 1.0/1 [00:02<00:00,  2.18s/it]

conda-25.3.0         | 1.1 MB    | : 100% 1.0/1 [00:02<00:00,  2.18s/it]

sundials-7.1.1       | 907 KB    | : 100% 1.0/1 [00:02<00:00,  2.38s/it]
```

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sundials-7.1.1     | 907 KB   | : 100% 1.0/1 [00:02<00:00,  2.38s/it]




libcholmod-5.3.1   | 1.1 MB   | : 100% 1.0/1 [00:02<00:00,  2.44s/it]




libcholmod-5.3.1   | 1.1 MB   | : 100% 1.0/1 [00:02<00:00,  2.44s/it]




assimulo-3.6.0     | 1.1 MB   | : 100% 1.0/1 [00:02<00:00,  2.67s/it]




assimulo-3.6.0     | 1.1 MB   | : 100% 1.0/1 [00:02<00:00,  2.67s/it]
```

```
gmp-6.3.0              | 449 KB    | : 100% 1.0/1 [00:02<00:00,  2.73s/it]




gmp-6.3.0              | 449 KB    | : 100% 1.0/1 [00:02<00:00,  2.73s/it]




libgcc-14.2.0          | 828 KB    | : 100% 1.0/1 [00:03<00:00,  1.60it/s]




libgomp-14.2.0         | 449 KB    | : 100% 1.0/1 [00:03<00:00,  2.98s/it]
```

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libgomp-14.2.0        | 449 KB    | : 100% 1.0/1 [00:03<00:00,  2.98s/it]




mpfr-4.2.1            | 620 KB    | : 100% 1.0/1 [00:03<00:00,  1.61it/s]




libumfpack-6.3.5      | 424 KB    | : 100% 1.0/1 [00:03<00:00,  3.13s/it]




libumfpack-6.3.5      | 424 KB    | : 100% 1.0/1 [00:03<00:00,  3.13s/it]
```

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fmilib-2.4.1         | 383 KB    | : 100% 1.0/1 [00:03<00:00,  3.20s/it]




fmilib-2.4.1         | 383 KB    | : 100% 1.0/1 [00:03<00:00,  3.20s/it]




libspqr-4.3.4        | 213 KB    | : 100% 1.0/1 [00:03<00:00,  3.26s/it]
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libspqr-4.3.4          | 213 KB   | : 100% 1.0/1 [00:03<00:00,  3.26s/it]




                    ... (more hidden) ...






     ... (more hidden) ...
scipy-1.15.2          | 16.4 MB  | : 100% 1.0/1 [00:04<00:00,  1.38s/it]
```

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Preparing transaction: - ▨▨\ ▨▨done
Verifying transaction: / ▨▨- ▨▨\ ▨▨| ▨▨/ ▨▨done
Executing transaction: \ ▨▨| ▨▨/ ▨▨- ▨▨\ ▨▨| ▨▨/ ▨▨- ▨▨\ ▨▨| ▨▨/ ▨▨- ▨▨\ ▨▨| ▨▨/ ▨▨-
▨▨\ ▨▨done
```

Notes: BPL_TEST2_PID_Fedbatch_reg

This notebook just produce the Figure 6 in the paper "Design ideas behind Bioprocess Library for Modelica", by J P Axelsson, to be presented in the 15th International Modelica Conference in Aachen, Germany, October 9-11, 2023.

Test run for in BPL_TEST2_PID test-case fedbatch_reg that demonstarate substrate control of the feed flow around fixed exponential dosage scheme. Note, that here is a small drift from mu_ref at the end.

Note For the JModelica compilation the derivative part and thus Td, and N cannot be used. Likely due to usage of MSL 3.2.2

Now specific installation and the run simulations. Start with connecting to Github. Then upload the two files:

- FMU - BPL_TEST2_PID_Fedbatch_reg6_linux_om_me.fmu
- Setup-file - BPL_TEST2_PID_Fedbatch_reg6_explore.me.py

In [9]:
```bash
%%bash
git clone https://github.com/janpeter19/CONF_2023_10_MODELICA15
```

```
Cloning into 'CONF_2023_10_MODELICA15'...
```

```
In [10]:  %cd CONF_2023_10_MODELICA15

          /content/CONF_2023_10_MODELICA15

In [11]:  run -i BPL_TEST2_PID_Fedbatch_reg6_explore.py

          Linux - run FMU pre-compiled OpenModelica

          Model for the process 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 simulation
           - describe()  - describe culture, broth, parameters, variables with values/units

          Note that both disp() and describe() takes values from the last simulation
          and the command process_diagram() brings up the main configuration

          Brief information about a command by help(), eg help(simu)
          Key system information is listed with the command system_info()

In [12]:  %matplotlib inline
          plt.rcParams['figure.figsize'] = [25/2.54, 20/2.54]

In [13]:  import warnings
          warnings.filterwarnings("ignore")

In [14]:  process_diagram()
```
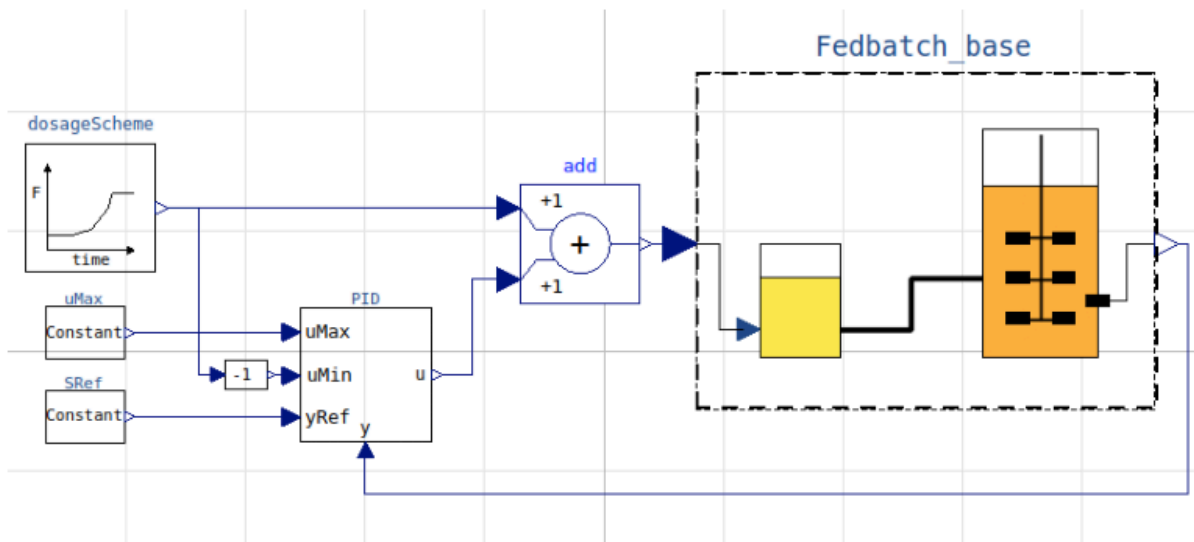


```
In [15]:  # Simulation of the process with controller
          par(Y=0.40, qSmax=1.0, Ks=0.1)                       # Culture parameters
          init(V_0=1e3, VX_0=1e3, VS_0=10*1e3)                 # Process initialization

          par(S_in=600)                                        # Feed profile
          par(t_start=4.3, F_start=4, mu_feed=0.2, F_max=35)
```
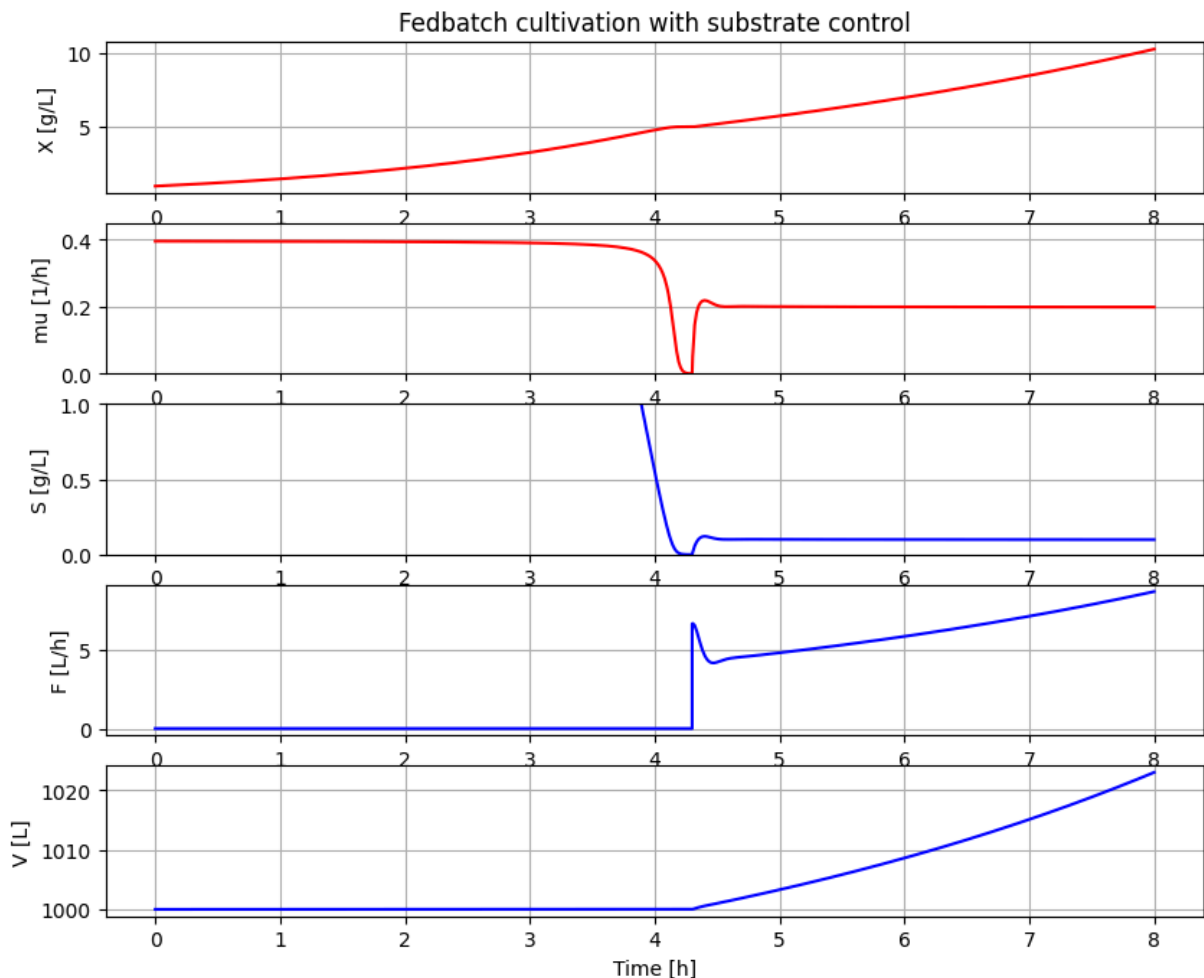
```
par(S_ref=0.1)                                         # Substrate controller
par(t_regStart=4.3)
par(uMax=50)

newplot()
ax2.set_ylim([0, 0.45]); ax3.set_ylim([0, 1])
setLines(['-']);
par(K=30, Ti=0.5)
simu(8)
```

Could not find cannot import name 'dopri5' from 'assimulo.lib' (/usr/local/lib/pytho
n3.11/site-packages/assimulo/lib/__init__.py)
Could not find cannot import name 'rodas' from 'assimulo.lib' (/usr/local/lib/python
3.11/site-packages/assimulo/lib/__init__.py)
Could not find cannot import name 'odassl' from 'assimulo.lib' (/usr/local/lib/pytho
n3.11/site-packages/assimulo/lib/__init__.py)
Could not find ODEPACK functions.
Could not find RADAR5
Could not find GLIMDA.

Fedbatch cultivation with substrate control

In [16]: describe('MSL')

MSL: 3.2.3 - used components: RealInput, RealOutput, LimPID-components

In [17]: system_info()

```
System information
 -OS: Linux
 -Python: 3.11.11
 -Scipy: not installed in the notebook
 -PyFMI: 2.16.3
 -FMU by: OpenModelica Compiler OpenModelica 1.21.0
 -FMI: 2.0
 -Type: FMUModelME2
 -Name: BPL_TEST2_PID.Fedbatch_reg6
 -Generated: 2023-08-22T10:54:51Z
 -MSL: 3.2.3
 -Description: Bioprocess Library version 2.1.1-beta
 -Interaction: FMU-explore version 0.9.8
```

In [17]: