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, 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.

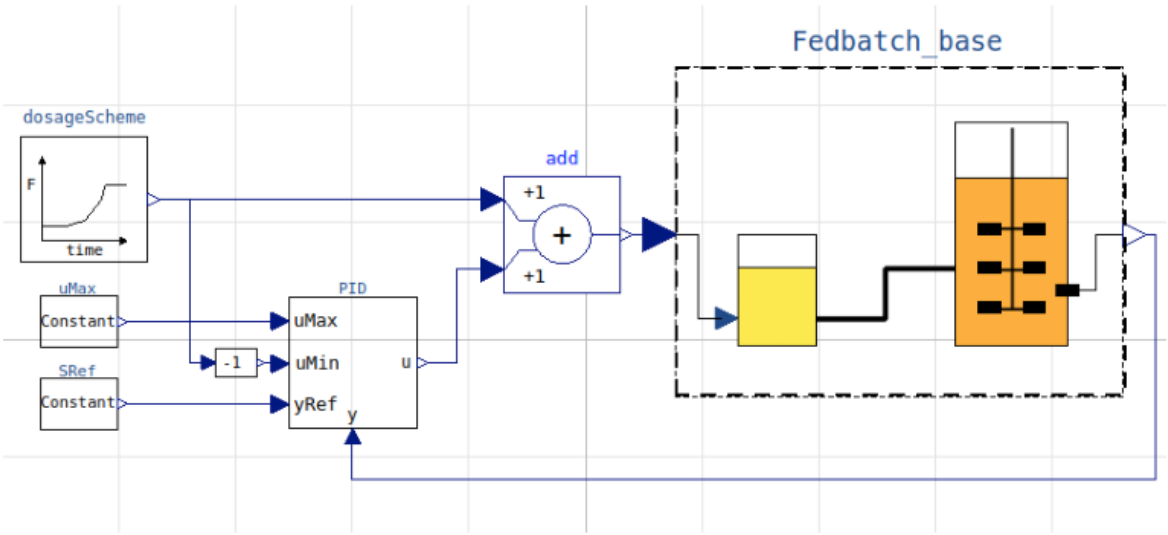
Note For the JModelica compilation the derivative part and thus Td, and N cannot be used. Likely due to usage of MSL 3.2.2

In [1]:
```
run -i BPL_TEST2_PID_Fedbatch_reg6_explore.py
```

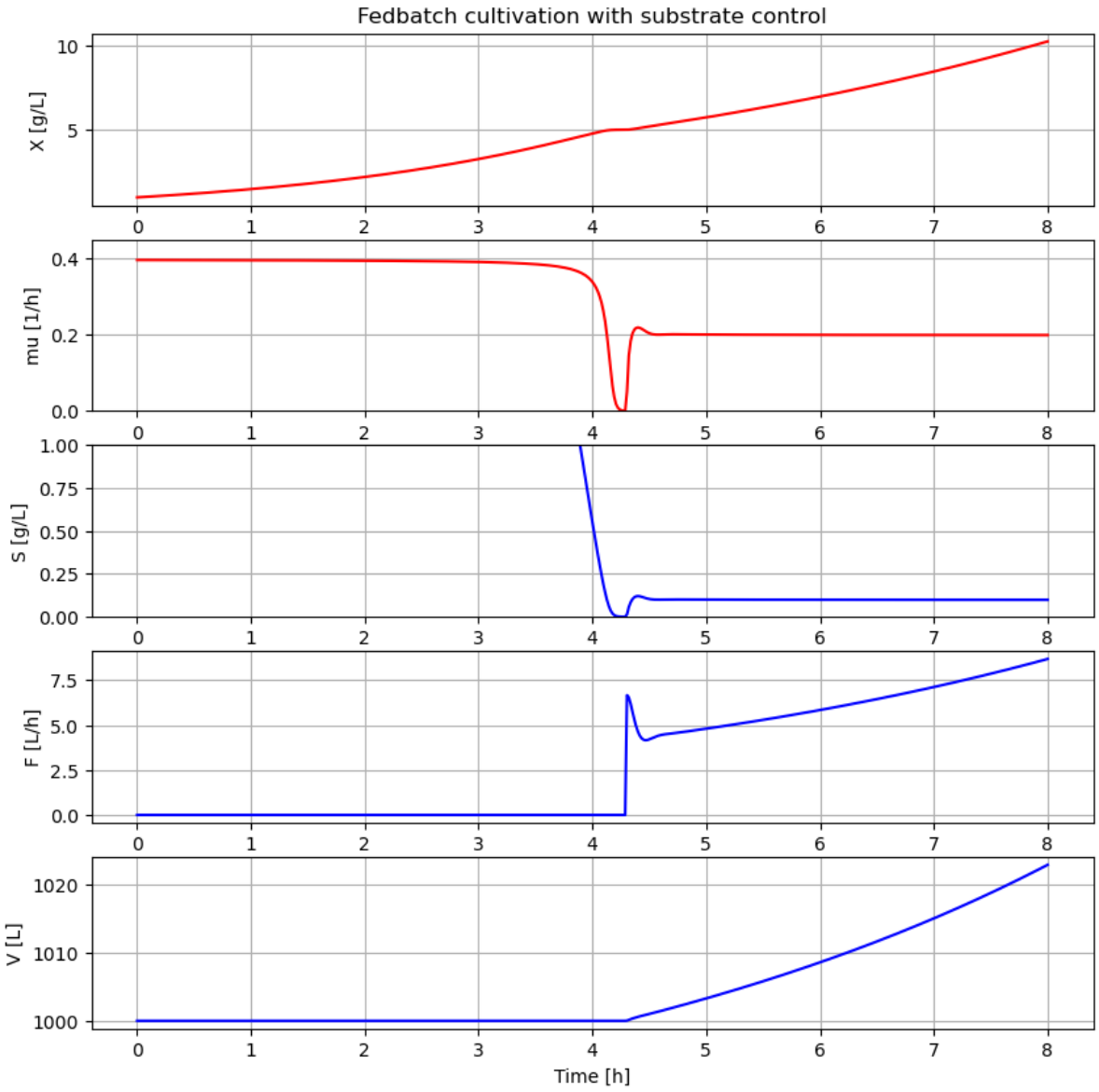
```
Windows - run FMU pre-compiled JModelica 2.14

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 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 [2]:
```
%matplotlib inline
plt.rcParams['figure.figsize'] = [25/2.54, 25/2.54]
```

In [3]:
```
process_diagram()
```



In [4]:
```
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)                                           # First simulation
```



In [5]:
```
system_info()
```

```
System information
 -OS: Windows
 -Python: 3.10.6
 -Scipy: not installed in the notebook
 -PyFMI: 2.10.3
 -FMU by: JModelica.org
 -FMI: 2.0
 -Type: FMUModelCS2
 -Name: BPL_TEST2_PID.Fedbatch_reg6
 -Generated: 2023-02-23T08:03:20
 -MSL: 3.2.2 build 3
 -Description: Bioprocess Library version 2.1.1-beta
 -Interaction: FMU-explore version 0.9.8
```

In [6]:
```
platform.version()
```

Out[6]:
```
'10.0.19045'
```

In [ ]:
```

```