

# 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 [7]: run -i BPL_TEST2_PID_Fedbatch_reg6_fmpy_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

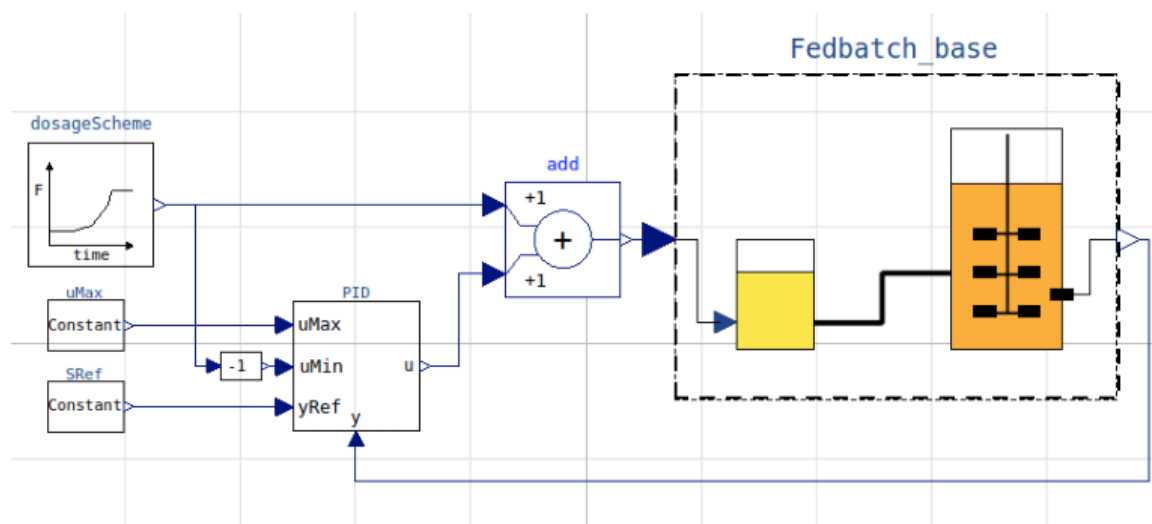
Brief information about a command by help(), eg help(simu)

Key system information is listed with the command system\_info()

<Figure size 984.252x984.252 with 0 Axes>

```
In [8]: %matplotlib inline
plt.rcParams['figure.figsize'] = [25/2.54, 25/2.54]
```

```
In [9]: process_diagram()
```



```

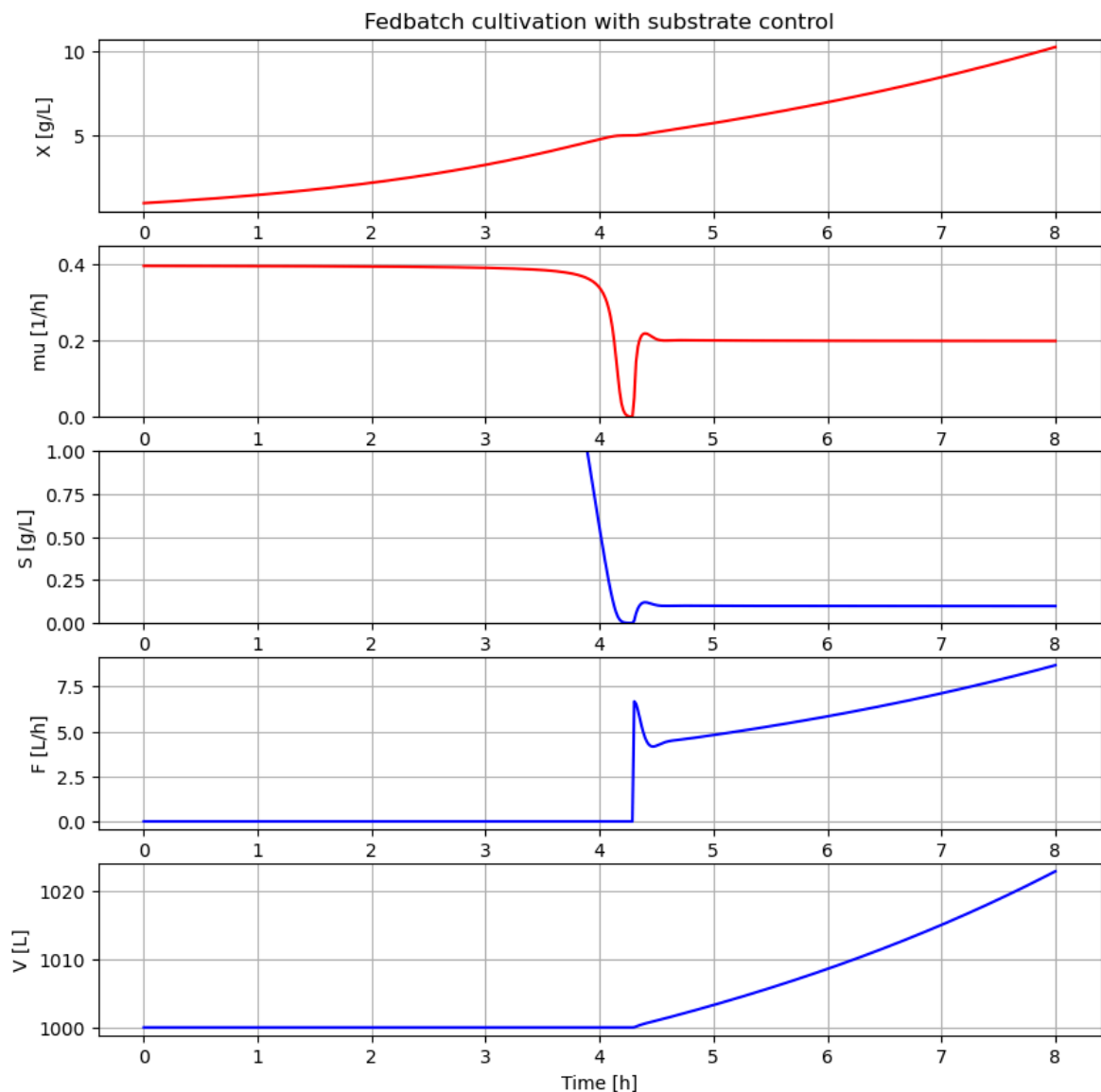
In [10]: par(Y=0.40, qSmax=1.0, Ks=0.1)           # Culture parameters
init(V_0=1e3, VX_0=1e3, VS_0=10*1e3)           # Process initialization

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 [11]: system_info()

```

## System information

- OS: Windows
- Python: 3.12.3
- Scipy: not installed in the notebook
- FMPy: 0.3.20
- FMU by: JModelica.org
- FMI: 2.0
- Type: CS
- 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 for FMPy version 0.9.8

In [12]: `platform.version()`

Out[12]: '10.0.19045'

In [ ]: