

BPL_TEST2_Fedbatch - demo

This notebook just produce the Figure 2 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.

Unfortunately the Linux FMU from OpenModelica does not work and therefore Windows FMU from JModelica is used. Thus Google Colab cannot run the example.

```
In [1]: run -i BPL_TEST2_Fedbatch_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

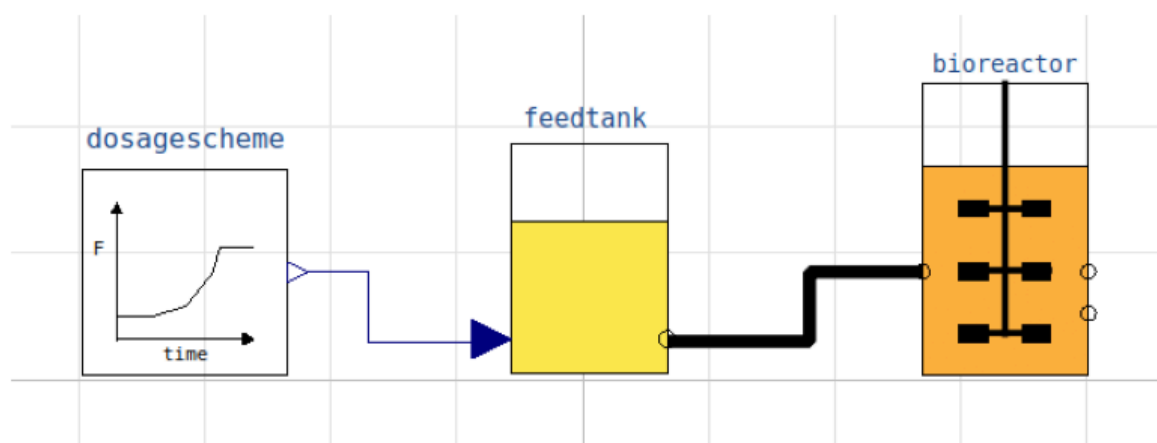
Note that both disp() and describe() takes values from the last simulation and the command process_diagram() brings up the main configuration

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

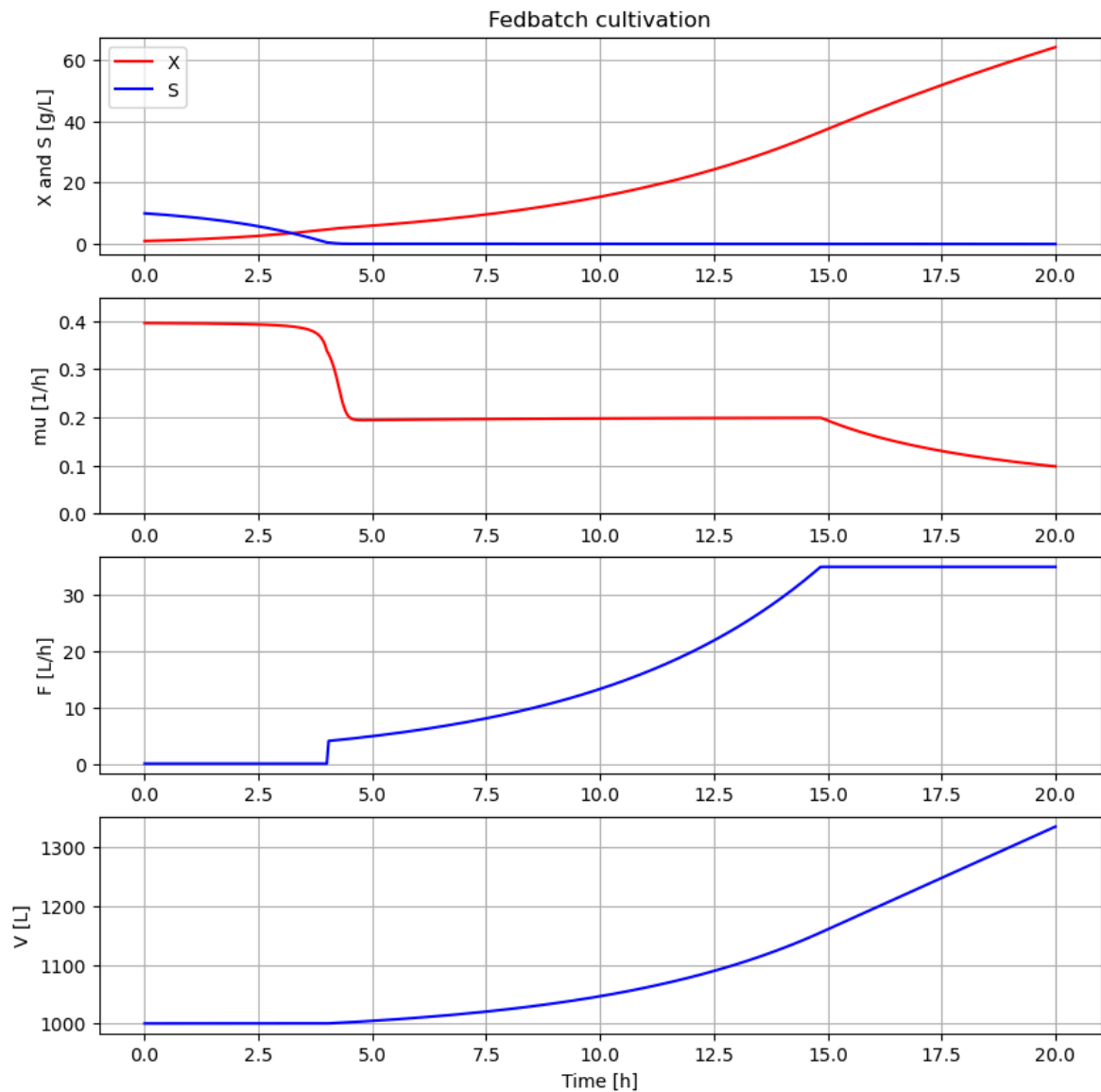
Key system information is listed with the command system_info()

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

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



```
In [4]: # Simulation with default values of the process
newplot(plotType='TimeSeries')
ax2.set_ylim([0, 0.45])
init(V_0=1000, VX_0=1*1e3, VS_0=10*1e3)
par(feedtank_S_in=600, Ks=0.1, Y=0.40)
par(t_start=4, F_start=4.0, mu_feed=0.2, F_max=35)
simu(20)
```



In [5]: `describe('mu')`

Cell specific growth rate variable : 0.098 [1/h]

In [6]: `describe('parts')`

['bioreactor', 'bioreactor.culture', 'dosagescheme', 'feedtank', 'liquidphase', 'MSL']

In [7]: `describe('MSL')`

MSL: RealInput, RealOutput

In [8]: `system_info()`

System information

- OS: Windows
- Python: 3.10.14
- Scipy: not installed in the notebook
- PyFMI: 2.16.1
- FMU by: JModelica.org
- FMI: 2.0
- Type: FMUModelCS2
- Name: BPL_TEST2.Fedbatch
- Generated: 2023-03-30T09:13:00
- MSL: 3.2.2 build 3
- Description: Bioprocess Library version 2.1.1
- Interaction: FMU-explore version 0.9.8

In []: