SSDSA Closed-loop tutorial: Exploring Steady State Behavior of an MSF Plant Case study

Objective: To study the steady state disturbance sensitivity analysis of an MSF in the closed loop mode.

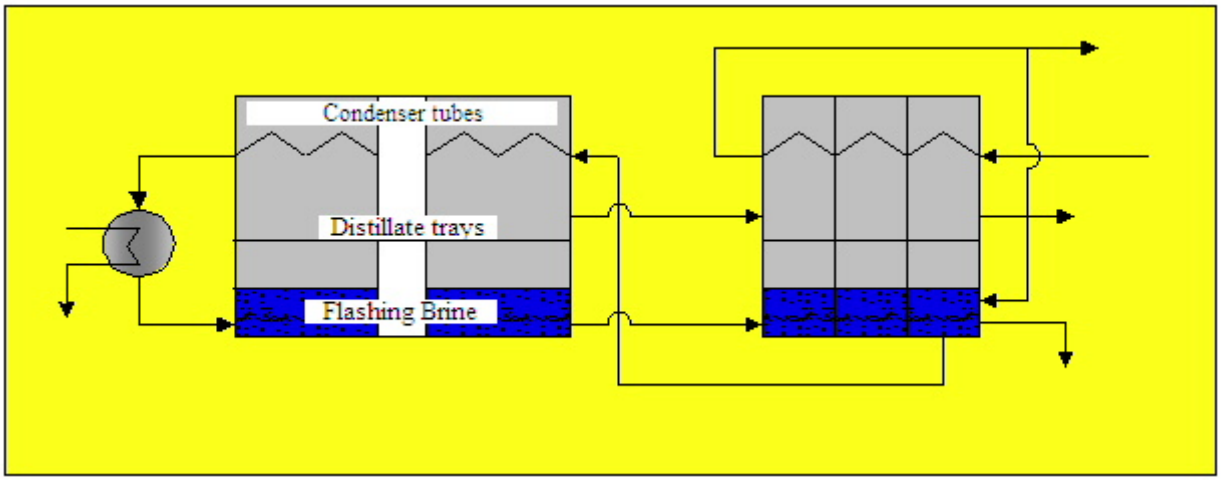
Note: In this tutorial, the MSF process is considered as an example. Similar procedure applies to other case studies.

Process description:

Schematic of the multi-stage flash desalination process is shown in Figure below. The process consists of 22 stages. The major components of the process such, brine level, brine temperature, condenser temperature in each stage are modeled. The main inputs to the process are the feed flow and temperature (W_f, T_f), the steam flow and temperature (W_s, T_s) and the brine recycle flow rate (B_0). The dominant output of the process is the distillate production rate, W_d. The most important controlled variable is the top brine temperature, T_{B0}.

The process variable: T_{B0}, W_d, B_D, L_{B22}, T_{B22}

The process inputs: W_s, T_f, B_0



Here we analyze the closed-loop static behavior of the MSF plant to variation in the process inputs (disturbances). This show how the measured variable responds at steady state to a range of changes in the feed conditions while certain inputs are used as manipulated variables, i.e. allowed to vary to compensate (counteract) for the disturbance effect. This analysis is essential for understanding the ability and efficiency of the chosen manipulated variable to control the process. Single loop and multiloops can be investigated.

Launching the SSDSA simulation module

At the main menu of the PCCL, select the MSF case study. In the sub menu, select steady state disturbance analysis. A new simulink window, that shows the MSF in open-loop mode, pops up. One typical steady state operating condition for the input variables is shown in the

corresponding boxes of the block diagram. Record these steady state values on the work sheet. To launch the SSDSA menu, simply click the *start* button.

Tutorial Procedure:

(1) Select one of the available disturbances by marking its checkbox.

(2) Select the closed loop mode.

(3) Select appropriate step size and number of steps.

(4) Select appropriate manipulated and controlled variable pair.

(5) Run the simulation by clicking the run button.

(6) Examine the generated plots.

(7) Discuss your results and make conclusions.

Additional steps:

(8) Repeat the above procedure for the same controlled variable but with another manipulated variable.

(9) Compare the results for the two different manipulated variables and make a conclusion.

(10) The user can reexamine all possible manipulated variables for the same controlled variable and comes uo with the best input-output pair.

Additional steps:

(11) The user can study the multivariable framework by selecting two controlled variable and two manipulated variable simultaneously and run the simulation.

(12) The user shall examine the results, discuss them and draw conclusions.

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