

NOTES FOR THE SOUTH EAST ASIA REFINERY DATA SET.

The process

The data are from a hydrogen reformer unit belonging to a SE Asian refinery, shown in Figure 1. The data set was first analysed by Dr A Vishnubhotla of Matrikon Inc in 1999, and published in [1] and [2] with permission of the refinery.

Figures 2 to 6 plot the normalized data set showing the process variables (PV), set points (SP), controller outputs (OP) and controller errors (SP-PV). The sampling interval was 1 min.

The analysis in [1] traced the origin of a plant-wide disturbance to the off-gas flow (Tag 34). The disturbance caused by this oscillating flow rate propagated throughout the plant.

The supplied data

The data plotted in Figures 2 to 5 are supplied electronically in the Excel file called **SEAsiaDatasetFromNFThornhill_NotesAndData.xls**. The PV and OP are *mean centred* and *normalized to unit standard deviation*. The ERR is (SP-PV) and has also been mean centered and normalized. The normalized value of ERR is not mathematically equal to (normalized SP – normalized PV) because the means and standard deviations of PV and SP might be different.

Many authors have also used a shorter SE Asia data set comprising just the first 512 points. Typically, they also are mean centered and scaled to unit standard deviation. However, the mean and standard deviation of the first 512 points are not the same as those for the whole data set.

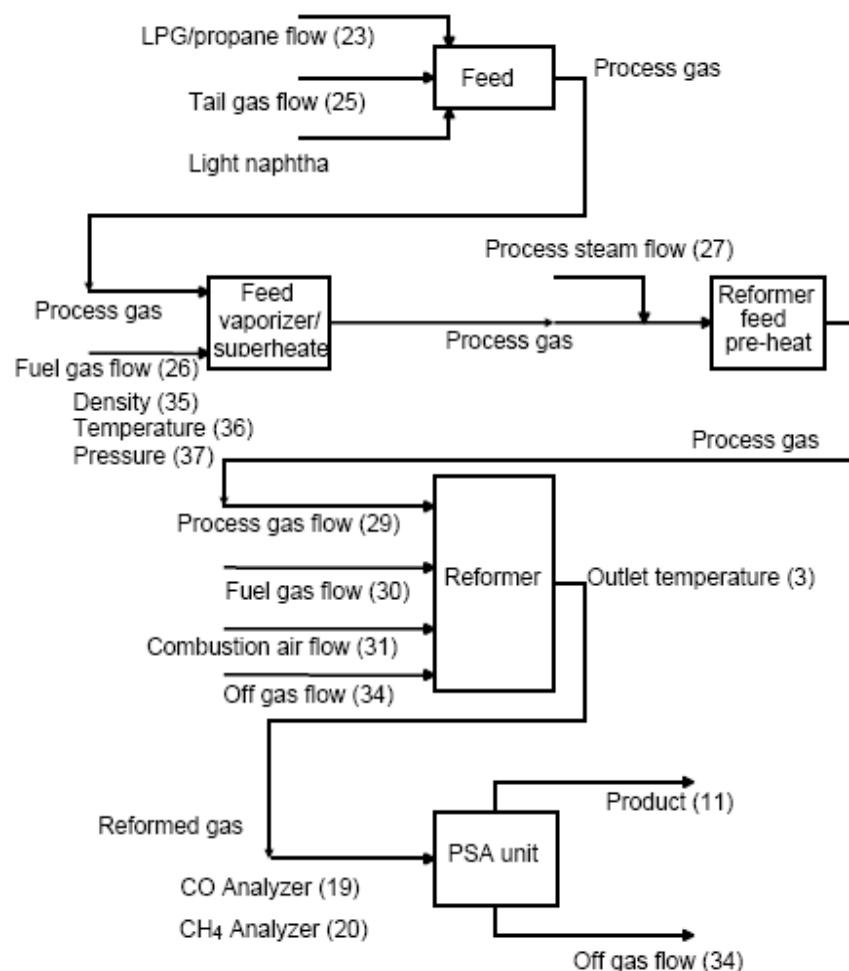


Figure 1. The SE Asia refinery plant schematic

Tagnumber	1	2	3	4	5	6	7	8	9	10
name	TC1	TC2	TC3	TC4	TC5	PC1	PC2	PC3	PC4	PC5
Tagnumber	11	12	13	14	15	16	17	18	19	
name	PI1	LC1	LC2	LC3	LC4	LC5	LC6	LC7	AI1	
Tagnumber	20	21	22	23	24	25	26	27	28	
name	AI2	AI3	AI4	FC1	FC2	FC3	FC4	FC5	FC6	
Tagnumber	29	30	31	32	33	34	35	36	37	
name	FC7	FC8	FC9	FC10	FC11	FI1	AIJ1	TIJ1	PCJ1	

Table 1. Tag numbers and names in Figure 1

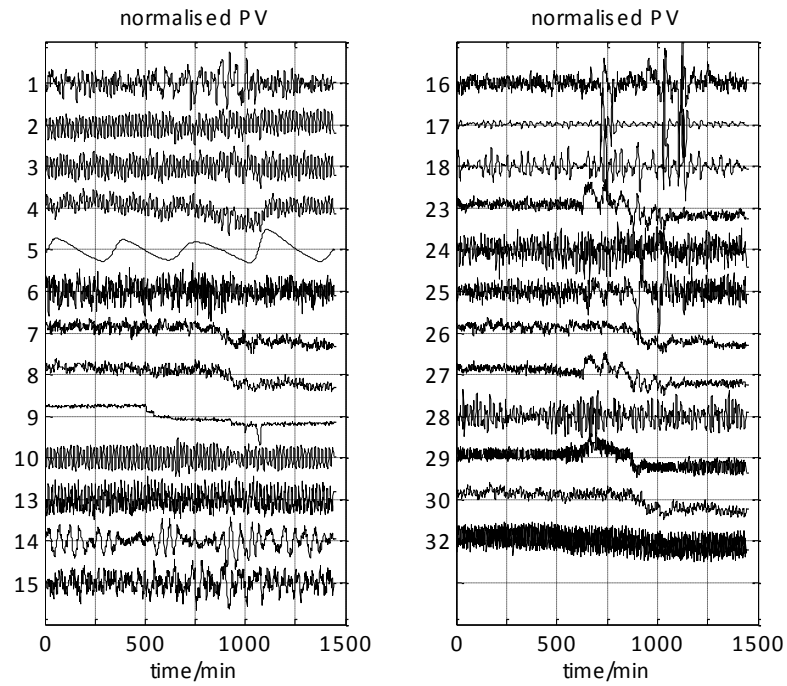


Figure 2. SE Asia refinery data set – normalized process variables for controllers

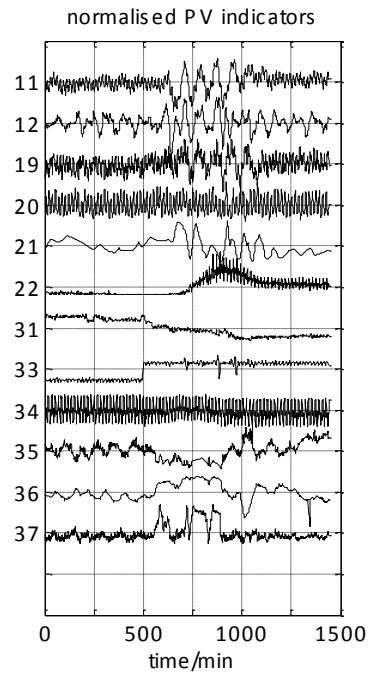


Figure 3. SE Asia refinery data set – normalized process variables for indicators.

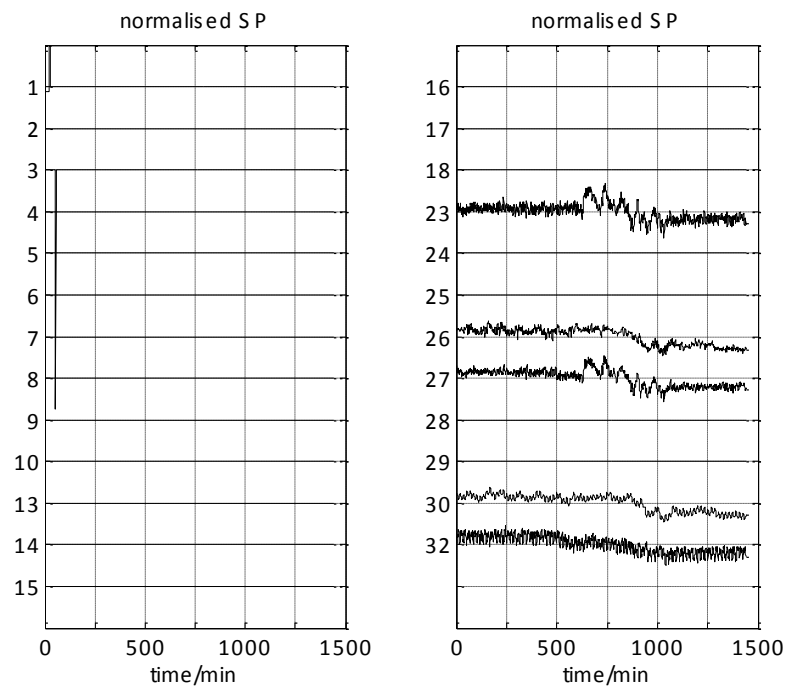


Figure 4. SE Asia refinery data set – normalized set points

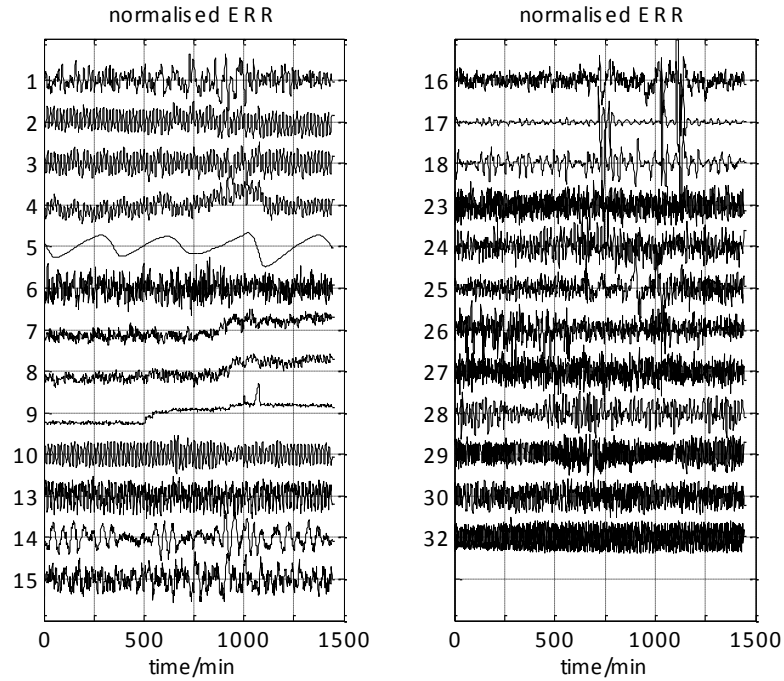


Figure 5. SE Asia refinery data set – normalized errors (PV-SP)

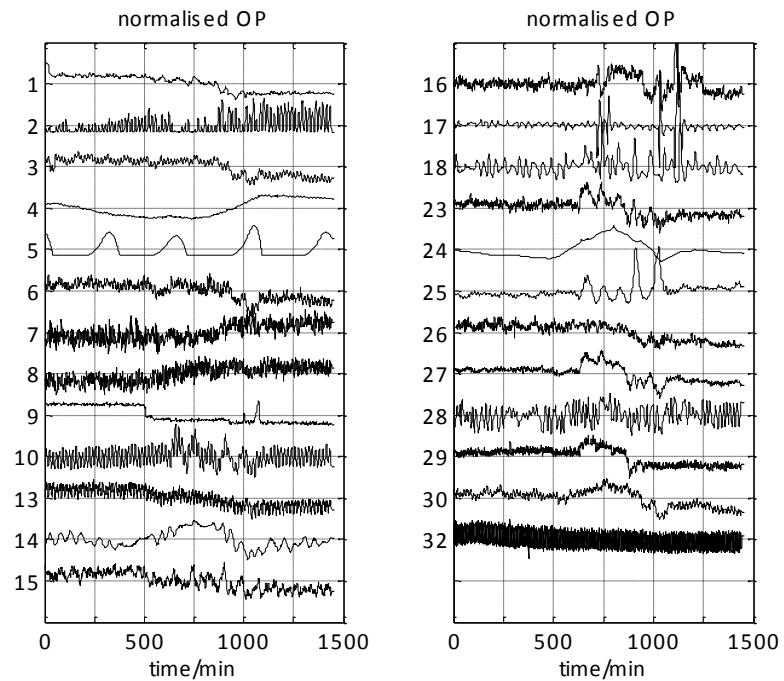


Figure 6. SE Asia refinery data set – normalized controller outputs

Reference:

- [1] Thornhill, N.F., Shah, S.L., Huang, B., and Vishnubhotla, A., 2002, Spectral principal component analysis of dynamic process data, *Control Engineering Practice*, 10, 833-846
- [2] Thornhill, N.F., 2005, Finding the source of nonlinearity in a process with plant-wide oscillation, *IEEE Transactions on Control System Technology*, 13, 434-443.