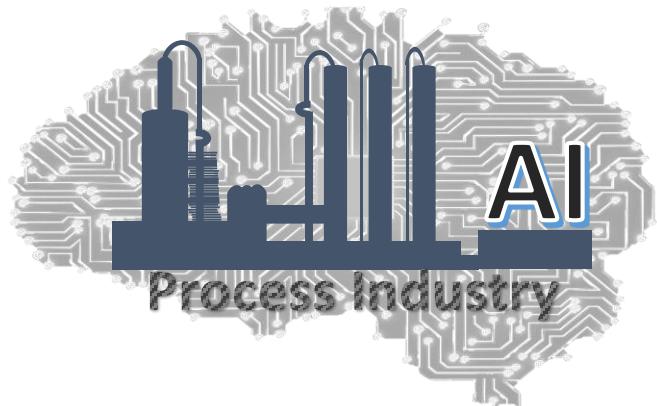


Statistical Techniques for Monitoring Industrial Processes



Lecture : PLS Modeling of LDPE Reactor

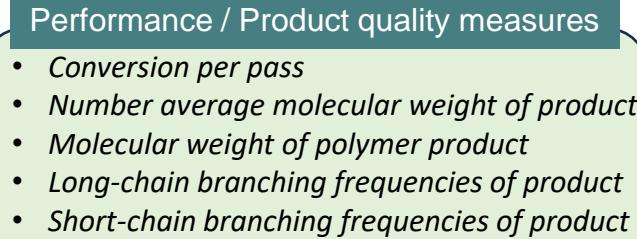
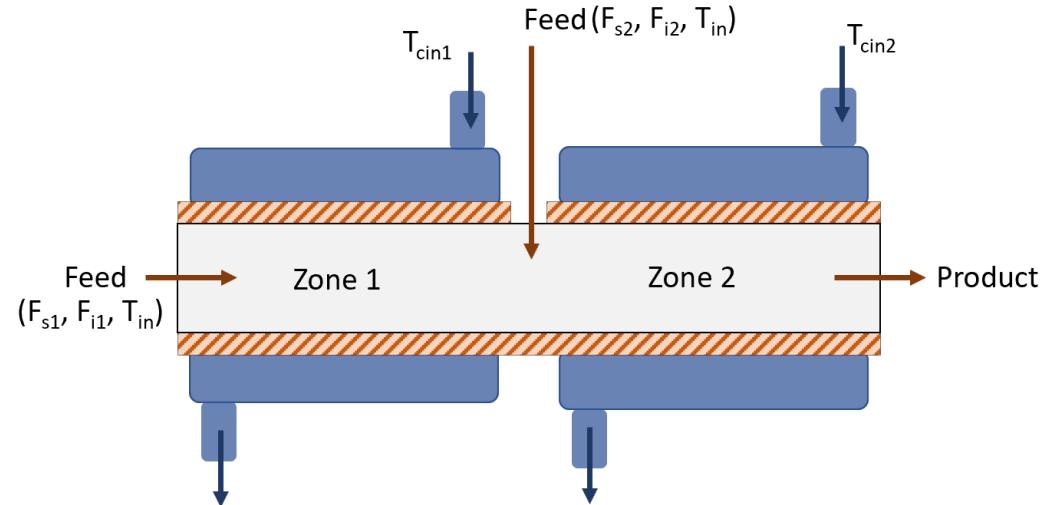
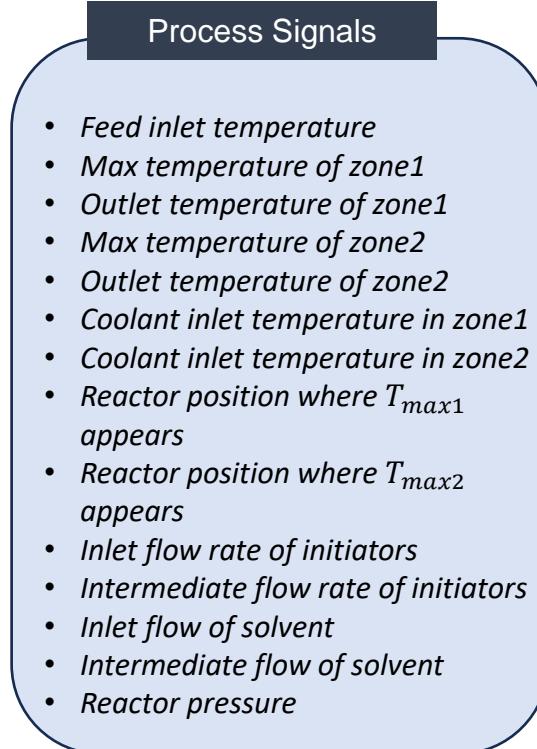
Module : PLS-based MSPM

Course TOC

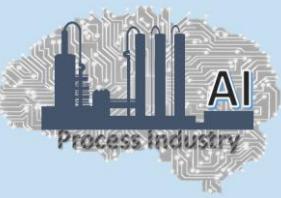
- Introduction to Statistical Process Monitoring (SPM)
- Python Installation and basics (optional)
- Univariate SPM & Control Charts
 - Shewhart Charts
 - CUSUM Charts
 - EWMA Charts
- Multivariate SPM
 - Principal Component Analysis (PCA)-based MSPM
 - Partial Least Squares (PLS) regression-based MSPM
 - Fault detection & diagnosis (FDD) using PLS
 - Application to a LDPE reactor monitoring
 - Strategies for handling nonlinear, dynamic, multimode systems
- Deploying SPM solutions



LDPE (Low-Density Polyethylene) Production Dataset*



- Multi-zonal tubular reactor
- 54 samples of 14 process variables, 5 quality variables
- A process fault occurs sample 51 onwards



PLS Modeling of LDPE Reactor



Build a PLS model using the first 50 samples as the training dataset



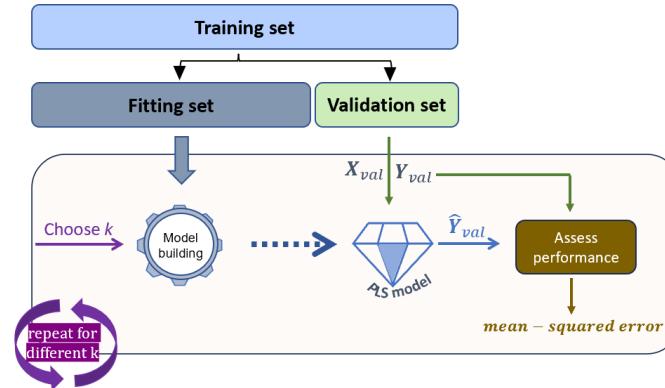
Explore the variances of different principal components and the correlations between them



Explore the variances explained in X space and Y space by the principal components cumulatively

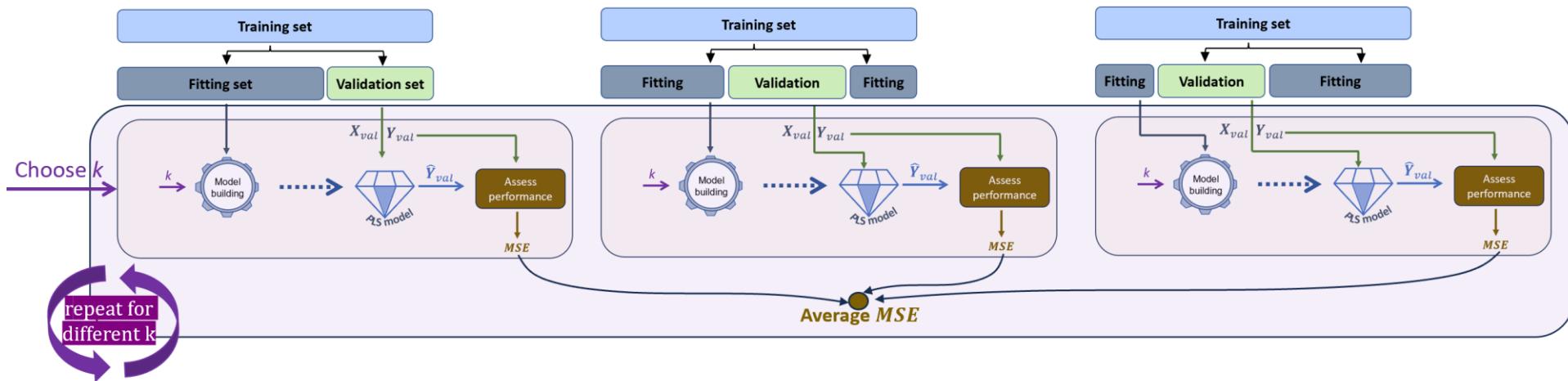
PLS: Choosing Number of Principal Components via Cross-validation

➤ 2-way holdout cross-validation



Select k that gives the minimum validation mean-squared error (MSE)

➤ K-Fold cross-validation



Select k that gives the minimum average MSE

Statistical Techniques for Monitoring Industrial Processes



Next Lecture : PLS – Fault Detection

Module : PLS-based MSPM

