Supplementary materials to “Adaptive cointegration analysis and principal component analysis with continual learning ability for monitoring multimode nonstationary processes”

1. Numerical case to explain Fig. 1

The data for Fig. 1 in Section II.B are generated by:

Mode $\mathcal{M}_1$:

$$\begin{cases} z_1 = 1.5t + 3 + e_1 \\ z_2 = t + 2.5 + e_2 \\ z_3 = -1.2t + 4.5 + e_3 \\ z_4 = 1.5 + e_4 \\ z_5 = 2.2 + e_5 \\ z_6 = 1.6t^2 - 0.1t + 0.2\sin t + 0.8 + e_6 \\ z_7 = 0.1\sqrt{t} + 0.2t + 0.3 + e_7 \end{cases}$$

Mode $\mathcal{M}_2$:

$$\begin{cases} z_1 = 1.5t + 3 + e_1 \\ z_2 = 2t + 2.5 + e_2 \\ z_3 = -0.7t + 4.5 + e_3 \\ z_4 = 1.7 + e_4 \\ z_5 = 0.9 + e_5 \\ z_6 = 0.6t^2 - 0.1t + 0.2\sin t + 0.8 + e_6 \\ z_7 = 0.3\sqrt{t} + 0.3t + 0.3 + e_7 \end{cases}$$

where the noise $e_i \sim N(0, 0.01), i = 1, \cdots, 7$. t is piecewise linear and follows uniform distribution with $t \sim U([0, 4.99])$.