System Identification of a Continuous-Time Linear System

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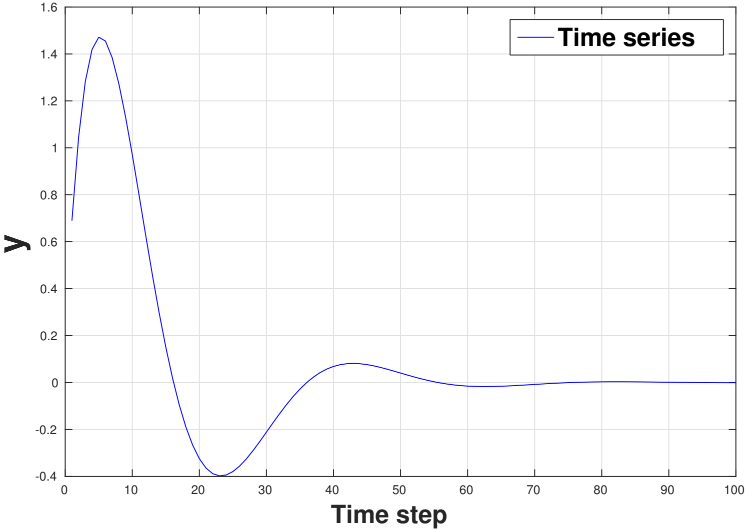
Example

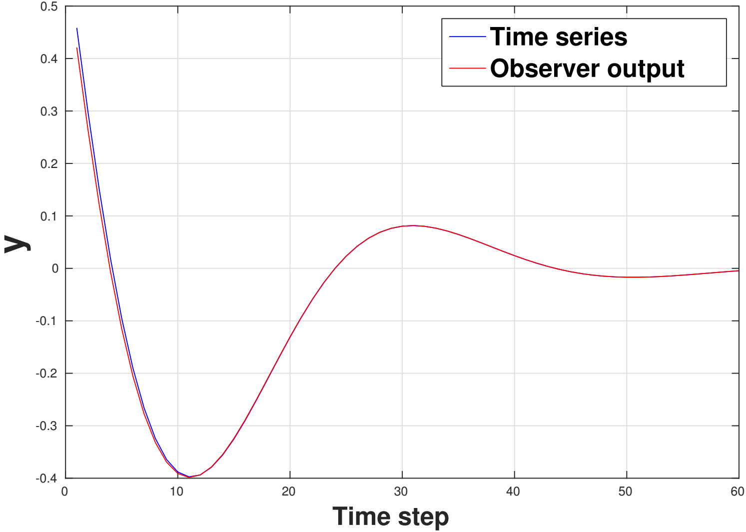
Example 6.4. Case of a linear system – System specification

$$
\begin{aligned}
\frac{dx(t)}{dt} &= Ax(t),\ x(0) = x_0,\\
y(t) &= Cx(t),\\
A &= \begin{pmatrix} 0.0 & 1.0 & 0.0 \\ -0.8 & -0.8 & 0.0 \\ 0.0 & 0.0 & -0.9 \end{pmatrix},\ x_0 = \begin{pmatrix} 1.5 \\ 0.0 \\ -0.8 \end{pmatrix},\\
C &= \begin{pmatrix} 1.1 & -0.8 & 1.2 \end{pmatrix},\\
& dx = 3,\ dy = 1, ds = 8,\\
& t1 = 20,\ \Delta t = 0.02,\ t1d = 100,\ tobsbegin = 13,\\
& tpast = 12,\ tfuture = 20,\ thyfuture = 4,\ thxo = 4.
\end{aligned}
$$

Example 6.4 - Simulation system



Example 6.4 - Prediction of identified system



Example

Example 6.4. Case of a linear system – Computed values

Observable canonical form used for observer and for system.

$$\begin{aligned}
\frac{dx_o(t)}{dt} &= A_{o,ocf}x_o(t) + K_o[y(t) - C_o x_o(t)],\ x_o(0) = x_{o,0}, \\
y_o(t) &= C_{o,ocf}x_o(t), \\
A_{o,ocf} = &= \begin{pmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -0.6070 & -1.4670 & -1.7104 \end{pmatrix}, \\
A_{ocf} &= \begin{pmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -0.7200 & -1.5200 & -1.7000 \end{pmatrix}, \\
C_{o,ocf} &= \begin{pmatrix} 1 & 0 & 0 \end{pmatrix} = C_{ocf}, \\
\Lambda_o &= \begin{pmatrix} -0.4432 + i\,0.7350 \\ -0.4432 - i\,0.7350 \\ -0.8240 \end{pmatrix},\ \ \Lambda = \begin{pmatrix} -0.4000 + i\,0.8000 \\ -0.4000 - i\,0.8000 \\ -0.9000 \end{pmatrix}.
\end{aligned}$$