Time Series Analysis
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Andreas Jakobsson

Consumption of district heating

Heat Consumption (GWh)

Air Temperature (°C)

Model Error

Model Error as it should be if the model were OK
Conditional expectations

\[ E\{Y|X = x\} = \int y f_{Y|X=x}(y) dy \]
\[ = \int y \frac{f_{X,Y}(x,y)}{f_X(x)} dy \]
\[ E\{g(X)Y\} = E\{g(X)E\{Y|X\}\} \]
\[ C\{Y,Z|X\} = E\{ (Y - E\{Y|X\})(Z - E\{Z|X\})^T|X \} \]
\[ C\{Y,Z\} = E\{ C\{Y,Z|X\}\} + C\{ E\{Y|X\}, E\{Z|X\}\} \]

Linear projection

We defined the linear prediction of \( y \) on to \( x \) as
\[ E\{y|x\} = a + Bx \]
Then, the prediction error is orthogonal with \( x \)
\[ C\{y - E\{y|x\}, x\} = 0 \]

The optimal linear prediction is formed as
\[ E\{y|x\} = m_y - R_{y,x}R_{x,x}^{-1}(x - m_x) \]
with error variance
\[ V\{e|x\} = R_{y,y} - R_{y,x}R_{x,x}^{-1}R_{y,x}^T \]