ADREC: Exercise Session 7

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1. Generate a dataset with 300 input-output samples from the system

   $$(1-1.3q^{-1}+0.9q^{-2})y(t) = (q^{-1}+0.4q^{-2})u(t)+(1-0.5q^{-1}+0.3q^{-2})e(t),$$

   where $u(t)$ and $e(t)$ are independent Gaussian white noise signals. Try some of the recursive algorithms that are available in Matlab, e.g., `rarmax`, `rplr`, `roe` and `rarx`. Try also different adaptation mechanisms (`'ff'`, `'ug'`, `'ng'`, `'kf'`) and adaptation gains. Which methods give accurate parameter estimates? How accurate are the methods when the model structure is incorrect, for example, when an OE or ARX structure is used?

2. Generate a dataset with 500 input-output samples from the system

   $$(1-1.3q^{-1}+0.9q^{-2})y(t) = 0.45q^{-n_k(t)}u(t)+e(t),$$

   where $u(t)$ and $e(t)$ are independent Gaussian white noise signals and where $n_k(t)$ is 1 initially but changes to 2 at $t = 250$. Try to detect this change by estimating an ARX model recursively, both when the model orders are high enough and in the case of undermodelling.

3. Simulate the EKF estimator for the first-order system in the article J2 (pp. 41-42) and investigate the issues of using the EKF as a parameter estimator in this case. Do you get the same result as in the paper?