

Problem set 4

Levinson- Durbin Algorithm and Lattice filters

Consider a signal $u(n)$ generated by an AR process of order 2:

$$u(n) = -a_1u(n-1) - a_2u(n-2) + v_1(n)$$

where $v_1(n)$ is a white noise sequence with variance σ_v^2 .

4.1 Starting from AR parameters a_1, a_2 and from noise variance σ_v^2 compute $r(0), r(1), r(2)$.
Hint: use Yule-Walker equations.

4.2 Starting from autocorrelation sequence $r(0), r(1), r(2)$ compute the AR parameters a_1, a_2 , and the noise variance σ_v^2 .
Hint: use Yule-Walker equations.

4.3 Write the iterations for the Levinson-Durbin algorithm.

4.4 Starting from the AR parameters a_1, a_2 find the reflection coefficients Γ_1, Γ_2 .
Hint: apply the inverse Levinson-Durbin algorithm.

4.5 Find the transfer function of the Lattice predictor of order 2, with parameters (reflection coefficients) Γ_1, Γ_2 .

4.6 Find the transfer function of the Lattice Inverse filter of order 2, with parameters (reflection coefficients) Γ_1, Γ_2 .