### Levinson-Durbin Recursion

Initialize the recursion

$$
\begin{aligned}
&a_{0,0} = 1 \\
&P_0 = r(0) \quad \text{Prediction error power} \\
&\text{For } m = 0, 1, \ldots, M-1 \quad \text{Filter order} \\
&\qquad \Delta_m = r(m+1) + \sum_{i=1}^{m} a_{m,i} r(m+1-i) \\
&\qquad \kappa_{m+1} = -\frac{\Delta_m}{P_m} \quad \text{Reflection coefficient} \\
&\qquad \text{for } i = 1, 2, \ldots, m \\
&\qquad\qquad a_{m+1,i} = a_{m,i} + \kappa_{m+1} a_{m,m+1-i} \\
&\qquad a_{m+1,m+1} = \kappa_{m+1} \\
&\qquad P_{m+1} = P_m (1 - |\kappa_{m+1}|^2)
\end{aligned}
$$

### Inverse Levinson-Durbin Recursion

Initialize the recursion

$$
\begin{aligned}
&r(0) = \frac{P_M}{\prod_{i=1}^{M} (1 - |\kappa_i|^2)} \\
&a_{0,0} = 1 \\
&\text{For } m = 0, 1, \ldots, M-1 \quad \text{Filter order} \\
&\qquad \text{for } i = 1, 2, \ldots, m \\
&\qquad\qquad a_{m+1,i} = a_{m,i} + \kappa_{m+1} a_{m,m+1-i} \\
&\qquad\qquad a_{m+1,m+1} = \kappa_{m+1} \\
&\qquad\qquad r(m+1) = -\sum_{i=1}^{m} a_{m,i} r(m+1-i)
\end{aligned}
$$

### Inverse Levinson-Durbin Recursion

Going from higher polynomial order to lower

$$
a_{m-1,k} = \frac{a_{m,k} - a_{m,m} a_{m,m-k}}{1 - |a_{m,m}|^2}
$$

Recursive relation for correlation

$$
r(m) = -\kappa_m P_{m-1} - \sum_{k=1}^{m-1} a_{m-1,k} r(m-k)
$$