

- Eigenvalues for AR(2) process:

$$\lambda_{\min} = \left(1 + \frac{a[1]}{1 + a[2]}\right) R_{uu}[0], \quad \lambda_{\max} = \left(1 - \frac{a[1]}{1 + a[2]}\right) R_{uu}[0].$$

- Condition number for AR(2) process:

$$\chi(\mathbf{R}) = \frac{1 - a[1] + a[2]}{1 + a[1] + a[2]}$$

- Eigenvectors:

$$\mathbf{V} = \frac{1}{\sqrt{2}} \begin{pmatrix} 1 & 1 \\ 1 & -1 \end{pmatrix}$$

- Optimal Wiener solution:

$$\mathbf{w}_{\text{opt}} = \begin{pmatrix} -a[1] \\ -a[2] \end{pmatrix}, \quad MMSE = \sigma_v^2$$

- Transformed tap-weight error:

$$\begin{pmatrix} q_1[n] \\ q_2[n] \end{pmatrix} = \begin{pmatrix} (1 - \mu\lambda_{\min})^n q_1[0] \\ (1 - \mu\lambda_{\max})^n q_2[0] \end{pmatrix}$$

- Trajectory for MSE:

$$J[n] = MMSE + \lambda_1 q_1^2[n] + \lambda_2 q_2^2[n].$$

- Small values of  $\mu$  result in overdamped MSE response.
- Larger values of  $\mu$  around  $2/\lambda_{\max}$  result in a underdamped MSE response.
- Locus of MSE for identical eigenvalues , fixed n : circle with center at origin and radius  $|J[n] - MMSE|/\lambda$ .
- Locus of MSE for unequal eigenvalues : ellipsoidal, semi minor/major axis:  $|J[n]-MMSE|/\lambda_{1,2}$