Time-Varying Systems and Computations

Unit 7.4

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Allpass – Minimum Phase Decomposition

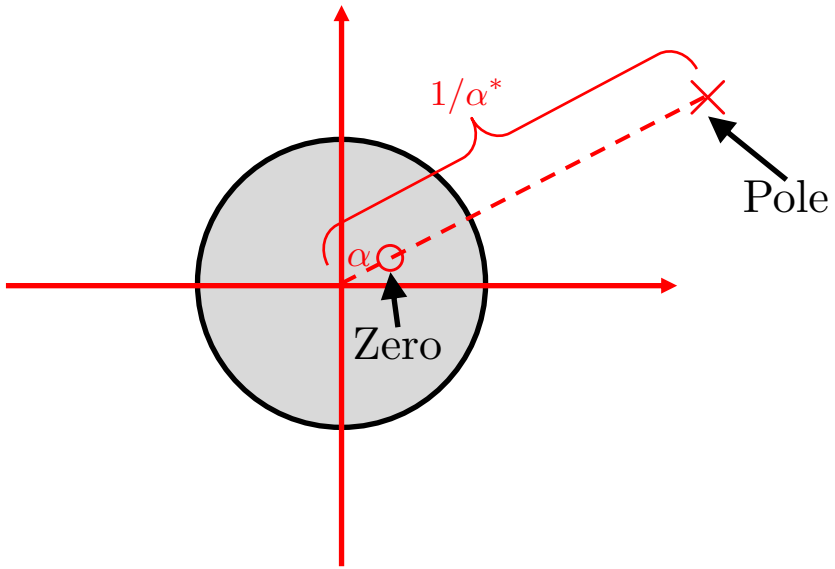
- Allpass Function – Inner Function

$$T_i(z) = \frac{z - \alpha}{1 - \alpha^* z} \qquad |\alpha| < 1$$

- Allpass Property

$$|T_{AP}(z)|_{z=e^{j\omega t}} = 1$$

- Not causaly invertible
- Pure phase function (delay)



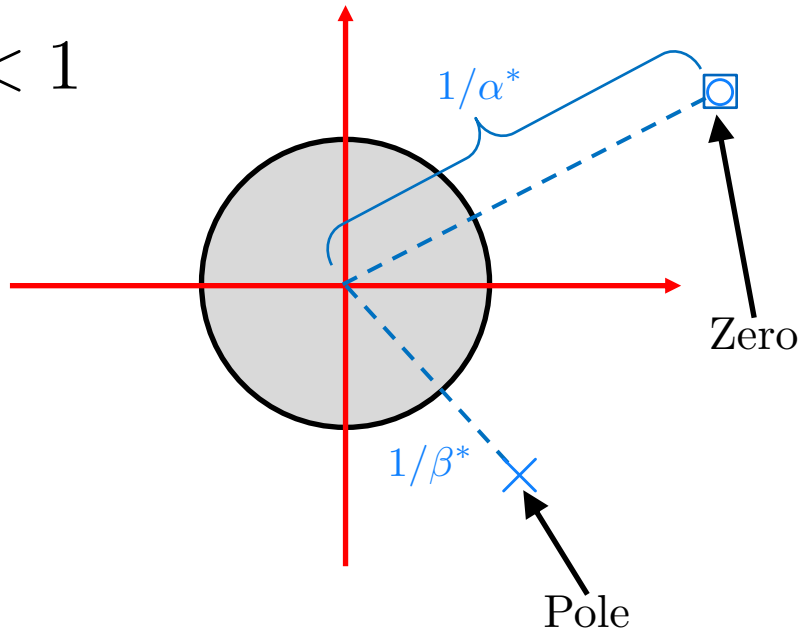
Allpass – Minimum Phase Decomposition

- Minimum Phase Function – Outer Function

$$T_o(z) = \frac{1 - \alpha^* z}{1 - \beta^* z} \qquad |\alpha, \beta| < 1$$

- Causally invertible
- Poles → Zeros, Zeros → Poles

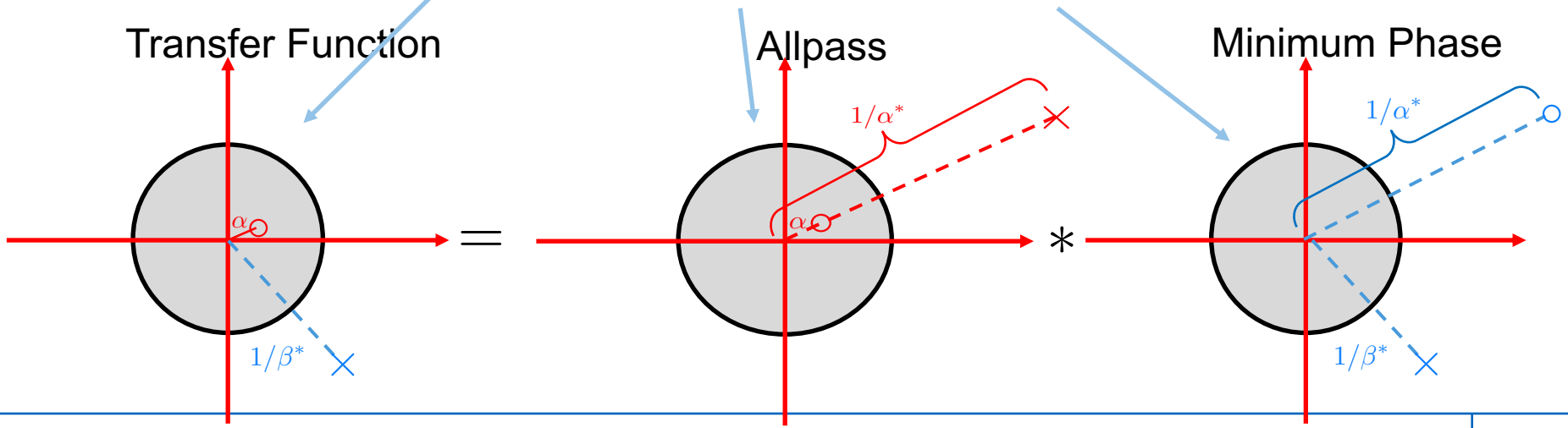
  Outside unit disk



Allpass – Minimum Phase Decomposition

- Transfer Function $T_(z) = T_i(z) \cdot T_o(z)$

$$T(z) = \frac{z-\alpha}{1-\beta^* z} = \frac{z-\alpha}{1-\alpha^* z} \cdot \frac{1-\alpha^* z}{1-\beta^* z}$$



Allpass – Minimum Phase Decomposition

- Very common operation for LTI systems

- Used for approximate inversion of transfer functions
- E.g. in audio signal processing (3D audio)

- Direction of arrrival estimation for telepresence applications