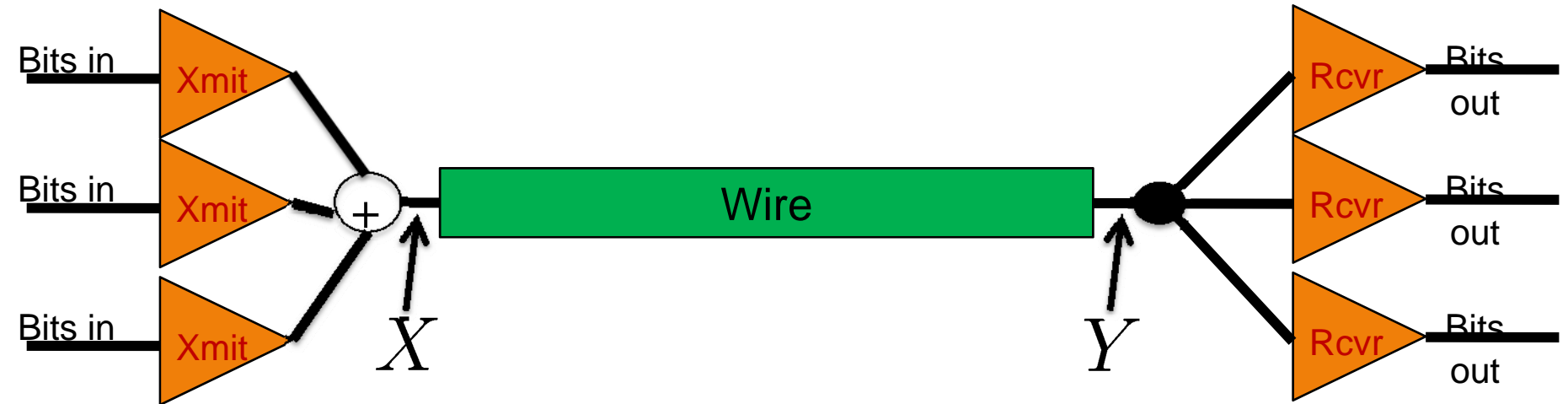


INTRODUCTION TO EECS II
**DIGITAL
 COMMUNICATION
 SYSTEMS**

6.02 Spring 2009 Lecture #13

- Filters using zeros
- Filters using poles
- Notch Filter Demo

New Problem - Resource Sharing



- Frequency Division Multiplexing Strategy
 - Represent each channel with a different frequency

- For LTI systems, frequencies do not mix

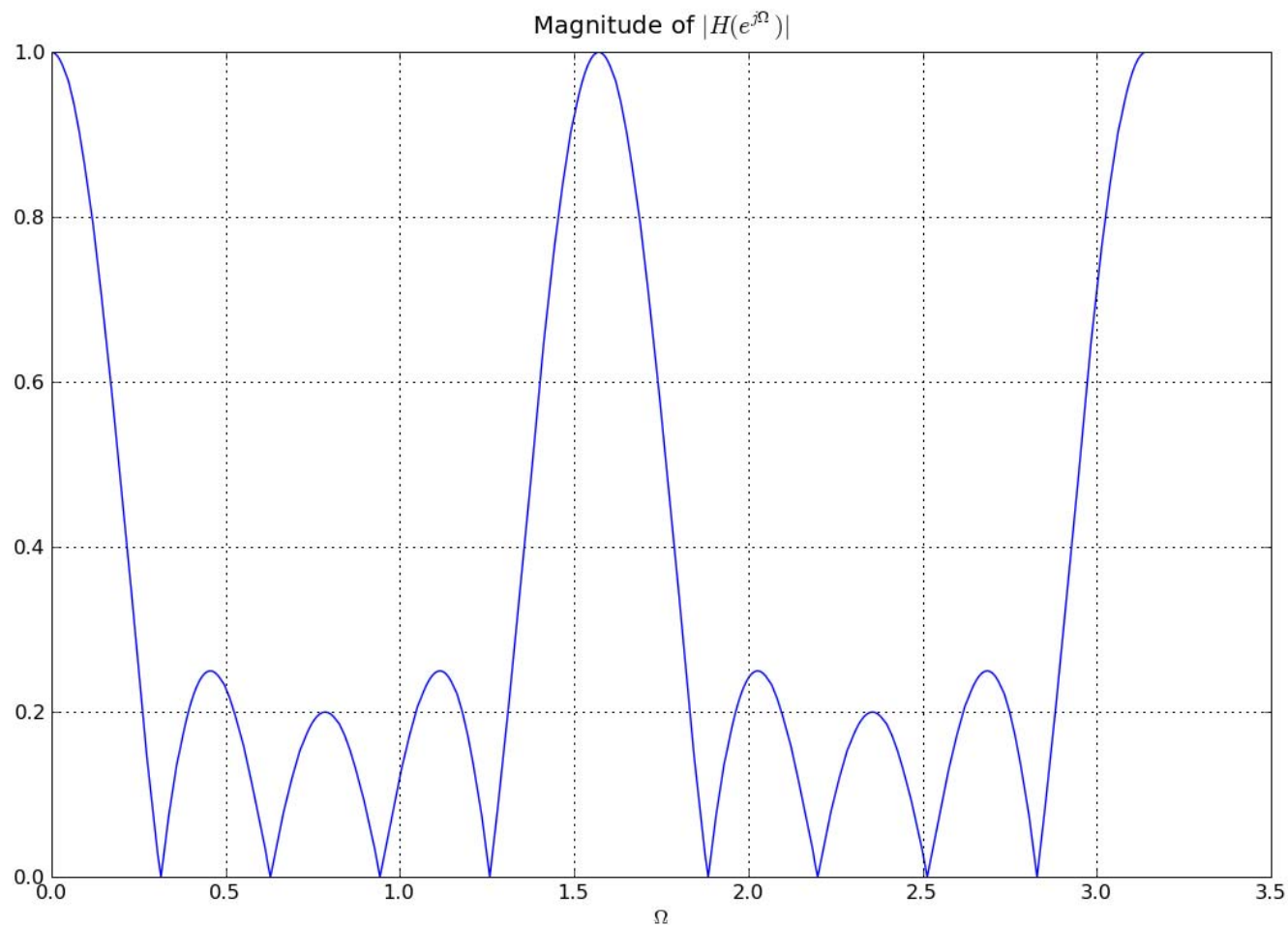
$$x[n] = A_1 e^{j\Omega_1 n} + \dots + A_K e^{j\Omega_K n}$$



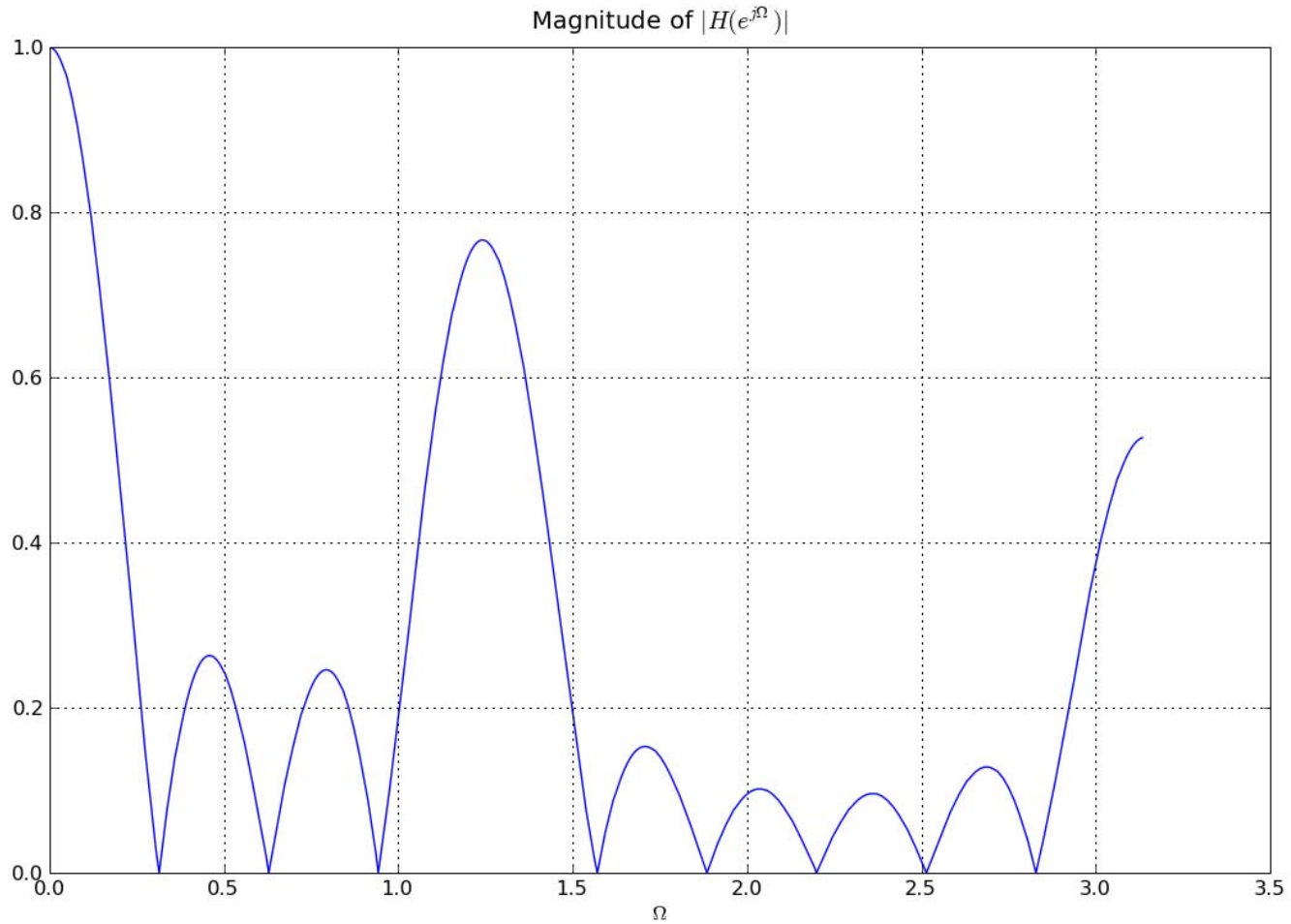
$$y[n] = H(e^{j\Omega_1}) A_1 e^{j\Omega_1 n} + \dots + H(e^{j\Omega_K}) A_K e^{j\Omega_K n}$$

- Now need to separate the different frequencies
 - Use Filters to separate Y in to different channels
 - LTI systems with specific frequency responses

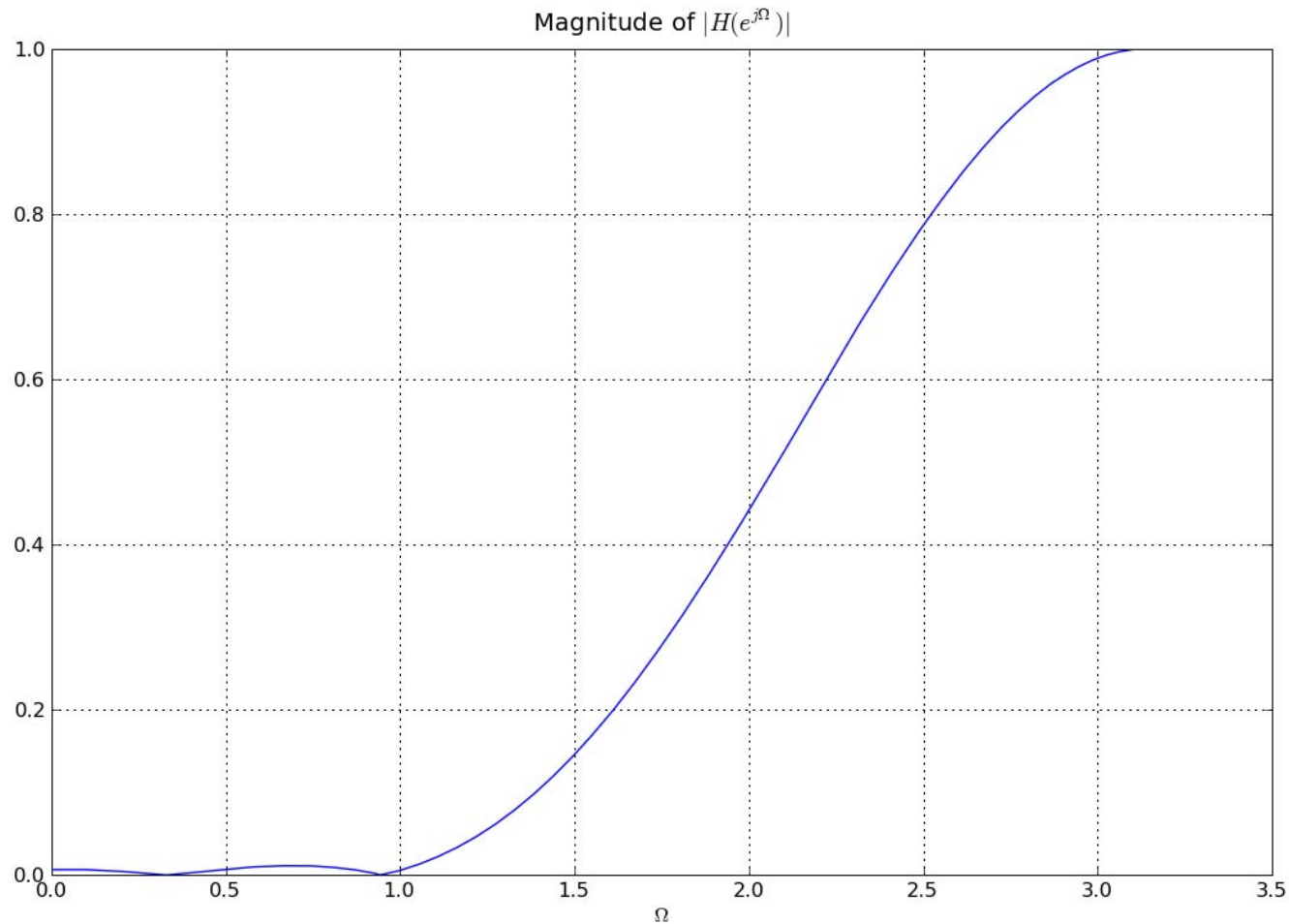
Channel 5, 8 Zeros Filter



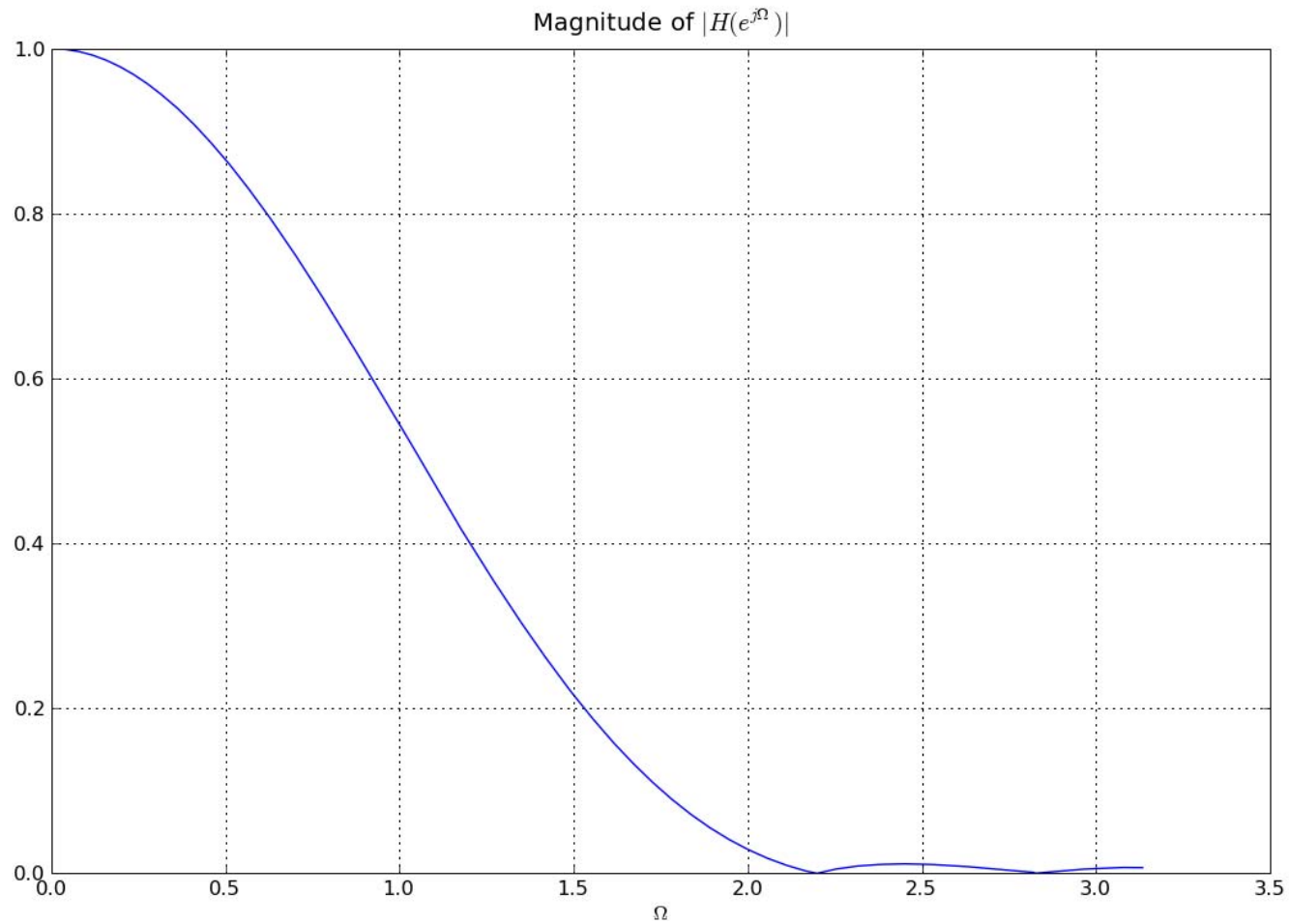
Channel 4, 8-pair Zeros Filter



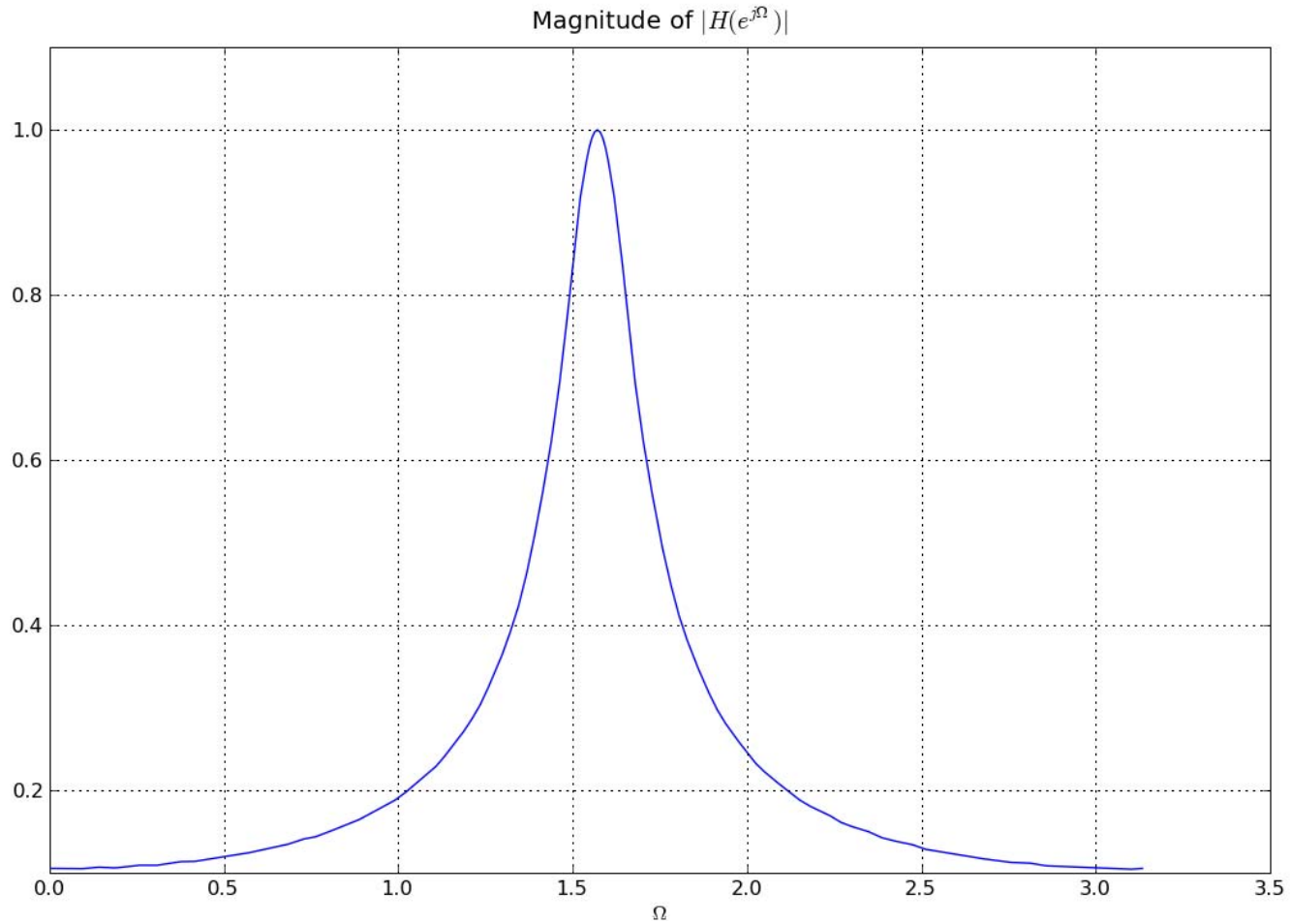
High Pass Filter, Two-pair Zeros



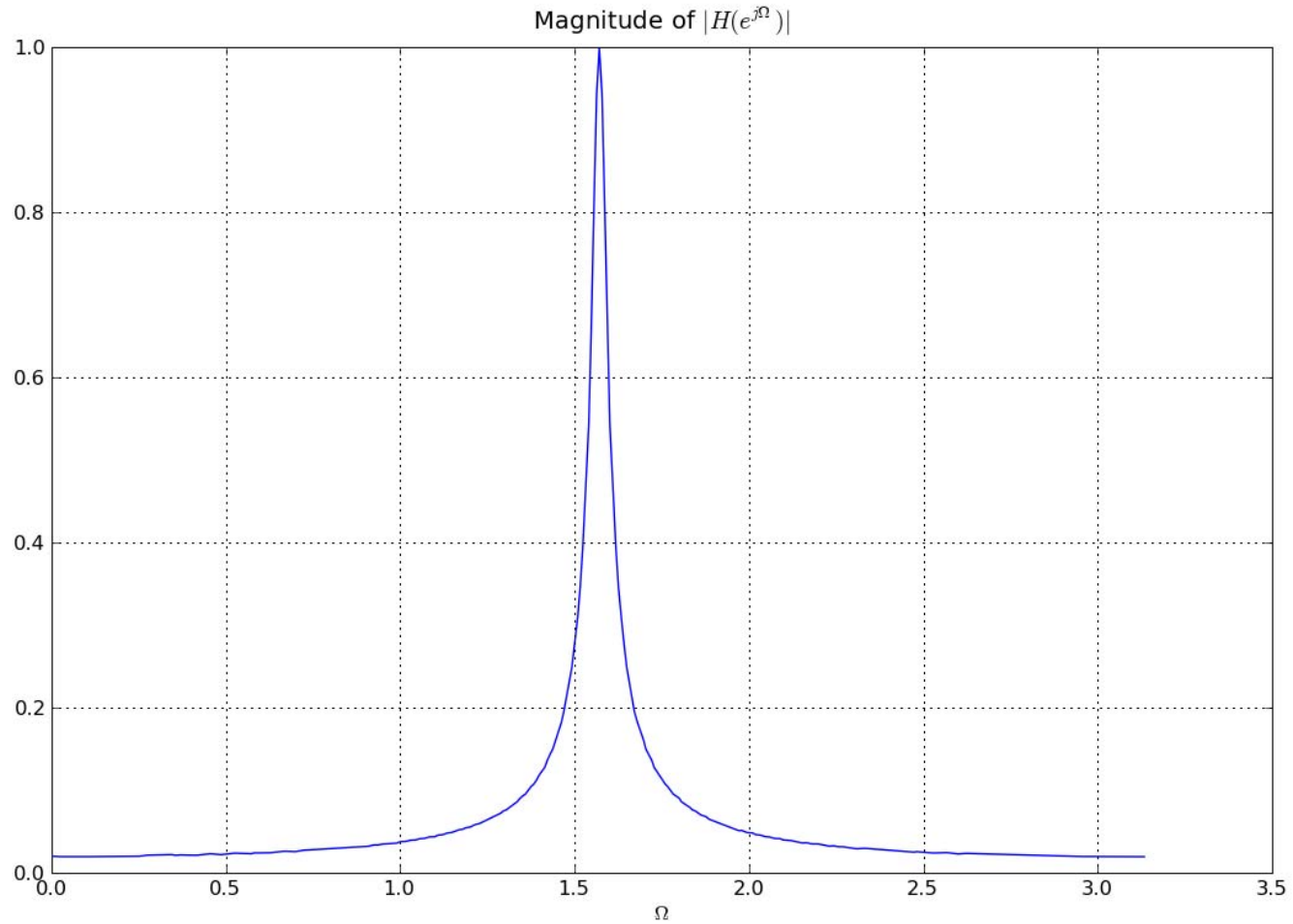
Low Pass Filter, Two-pair Zeros



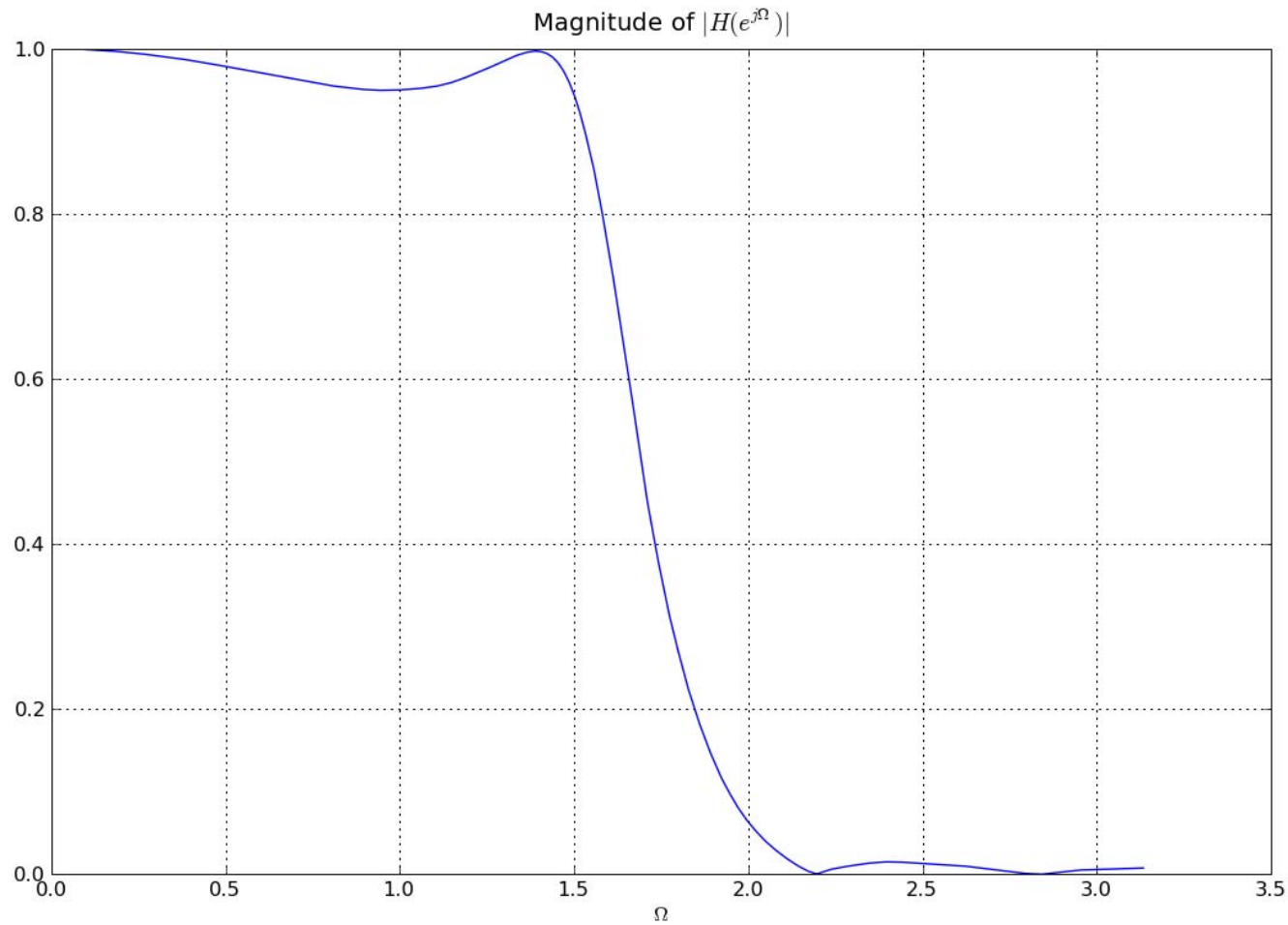
One-pair Poles Bandpass Filter $r=0.9$



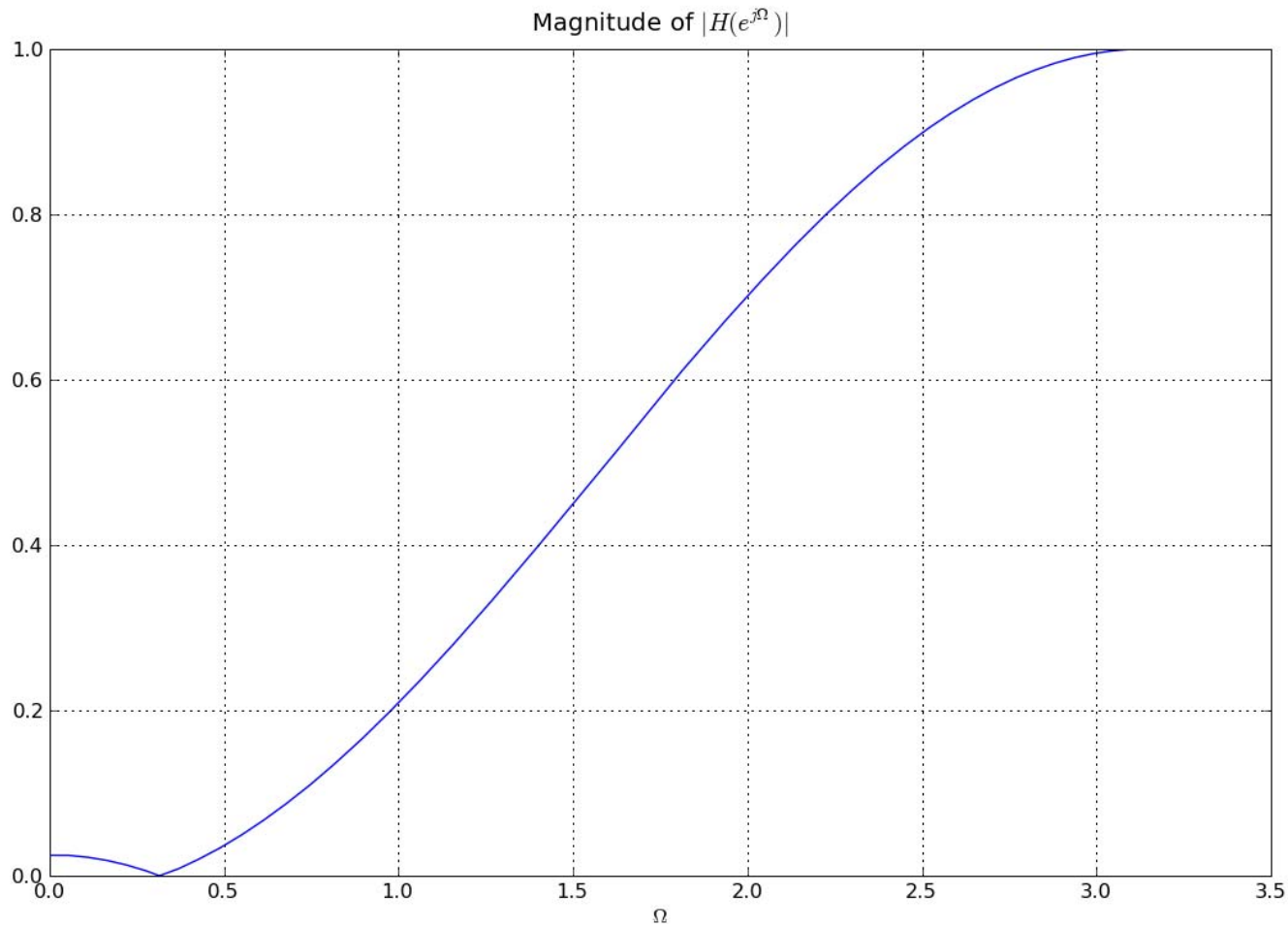
One-pair poles Bandpass Filter $r=0.98$



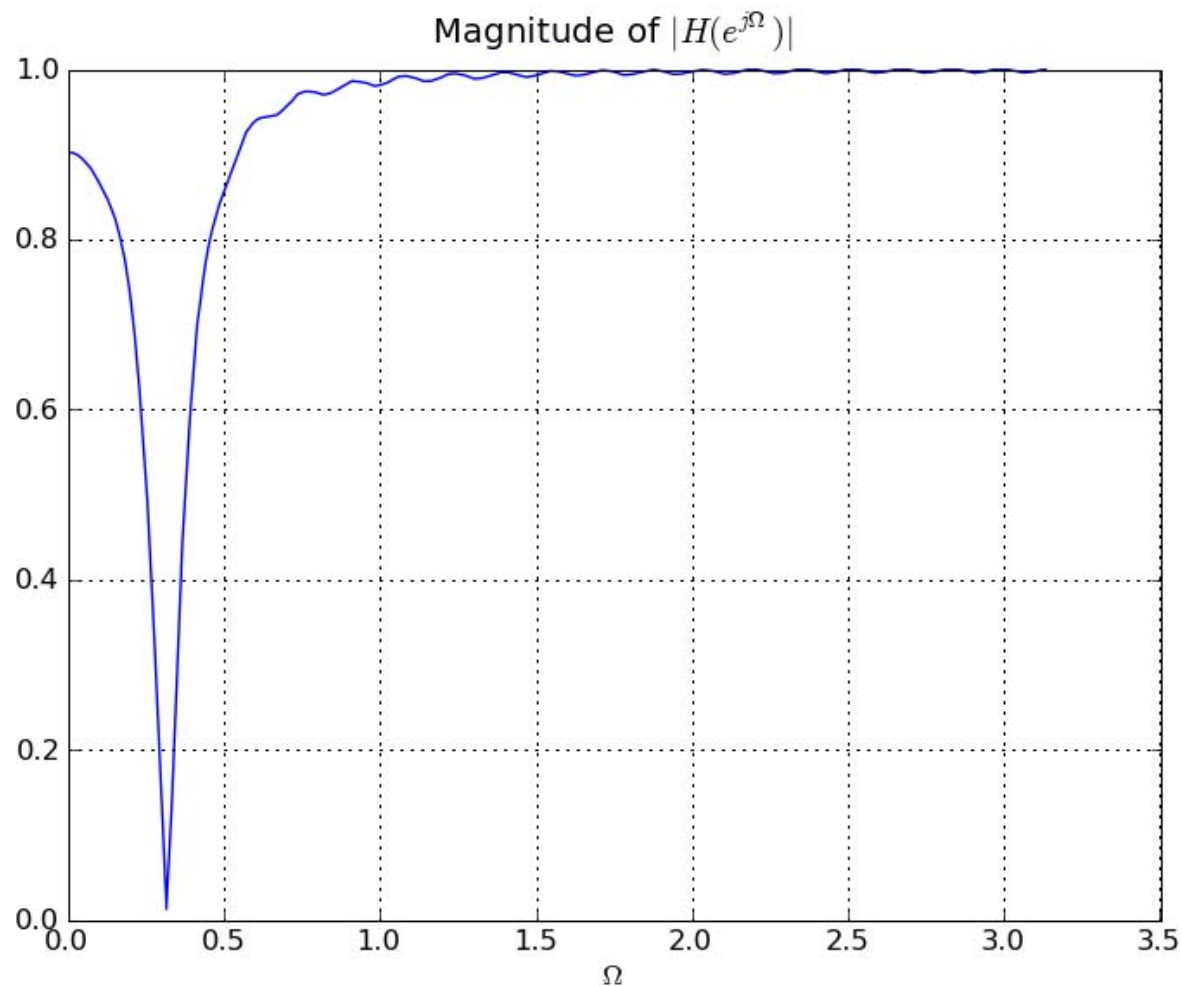
One pole-pair, two zero pairs LPF



One zero-pair notch filter



One Zero-pair, One Pole-pair Notch



Notch Unit Sample Response

