Spectral Theory

Chapter 1: The Fourier Integral Transform and Related Topics

Fourier Integral Transform X(ω), convolution, RC filter, conventions, Laplace Transform, reflection rule for X(ω), area rules, Parseval's Theorem, other rules, examples, the square pulse, exponential sums, delta function technology, sinc function history, meaning of negative frequencies, Final and Initial Value theorems

Chapter 2: Pulse Trains and the Fourier Series Connection

spectrum of a pulse train, Fourier Series, square wave case,
discrete spectra, biphase case, some Excel graphs

Chapter 3: Sampled Signals

definition of T_1, sampled signals and image spectra,
digital filters and their image spectra, the **Digital Fourier Transform** X'(ω),
relation between Digital and Analog transforms, the **Z Transform**,
digital RC filter, poles and flip-flops, digital filter circuits,
amplitude modulated pulse trains, aperture correction,
Discrete Fourier Transform and comparison to Analog
the **Fast Fourier Transform**, the **Nyquist Sampling Theorem**

Chapter 4: Some Practical Topics

digital FIR and linear phase, origins of image spectra,
oversampling and decimation

Chapter 5: Some Theoretical Topics

dispersion relations for X(ω) and γ(ω), Hilbert Transform,
Kramers-Kronig, filter implications, **dispersion** and
attenuation, implication for **coaxial cable**

Chapter 6: Statistical Pulse Trains

autocorrelation, relation to spectral energy density, examples,
application to **pulse trains**, statistics, coefficients,
spectral densities of various line codes: NRZ, RZ, Manchester, AMI
spectral densities of NRZ, **MPSK**, **QAM**, bipolar NRZ, MSK