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- 1.1 Brief historical survey
- 1.2 Linear-system model
- 1.2.1 Assumptions
- 1.2.2 Derivation
- 1.2.3 Results
- 1.3 Focal spot and magnification
- 1.3.1 Derivation of focal spot psf
- 1.3.2 Derivation of total system psf
- 1.3.3 Optimal magnification
- 1.4 Scatter
- 1.4.1 Modeling of Scatter psf
- 1.4.2 Effect of scatter on radiation contrast (Rose Model)
- 1.4.3 Anti-scatter grid

2 Lecture Two: Introduction to Diagnostic x-ray Imaging (Part II Detectors)

- 2.1 Ideal detector
- 2.2 Detector metrics
- 2.2.1 SNR
- 2.2.2 DQE
- 2.2.3 NEQ
- 2.3 Analog Detectors
- 2.3.1 Film structure
- 2.3.2 Optical density / H&D Curve
- 2.3.3 Important Film properties (speed, etc.)
- 2.3.4 Intensifying Screen
- 2.3.5 DQE of film
- **2.3.6** MTF of film
- 2.3.7 Physics modeling of Film (Ag grain density, etc)
- 2.3.8 Model of intensifying Screen PSF
- 2.3.9 MTF of Screen-Film
- 2.4 Digital Detectors
- 2.4.1 Intro

3 Lecture Three: Introduction to Image Quality

- 3.1 Conceptual Introduction
- 3.2 Attributes of Image quality
- 3.2.1 Contrast
- 3.2.2 Resolution
- **3.2.3** Noise
- 3.3 Physical quantification of image quality
- 3.3.1 SNR
- 3.3.2 Linear-System Analysis
- 3.4 Review of useful concepts
- 3.4.1 Central-limit theorem
- 3.4.2 Gaussian random variable
- 3.4.3 Poisson statistics
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- 3.4.6 Ensemble average
- 3.5 Linear transfer of signal and noise
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- 3.6 SNR Calculations
- 3.6.1 Rose Model SNR
- 3.6.2 Effect of Scatter: Constant Patient Exposure
- 3.6.3 Effect of Scatter: Constant Detector Entrance Exposure

- 4 Lecture Four: DQE and NEQ
- 4.1 Definitions
- 4.2 Derivation of DQE for Poisson-impulse object
- 4.2.1 For Digital Systems
- 4.2.2 For Screen-Film systems
- 4.2.3 Comparison
- 4.2.4 Effect of Poisson vs. additional detector noise
- 4.3 Derivation of NEQ

5 Lecture Five: Image Interpretation

- 5.1 Six levels of Efficacy
- 5.2 The ideal observer
- 5.2.1 Likelihood Ratio
- 5.3 A few mathematical observers
- 5.3.1 Pre-whitening filter
- 5.3.2 Matched filter
- 5.3.3 Wiener filter
- 5.4 Human observers
- 5.4.1 Reader Variability
- 5.5 Model observers

6 Lecture Six: Toward Quantitative Imaging

- 7 Additional notes: "Focal Spot.pdf"
- 7.1 Focal spot, linear systems model, MTF
- 7.2 Noise
- 7.2.1 NPS and magnification
- 7.3 Effect of Geometric Magnification on SNR

- 8 Additional notes: "Lecture 1-additional.pdf"
- 8.1 Purpose of Diagnostic Radiology
- 8.2 Rose Model of SNR
- 8.3 X-Ray Detectors
- 8.4 Types of X-ray Detectors
- 8.5 Image Quality Properties of X-ray Detectors
- 8.5.1 Contrast
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- 8.5.6 X-ray Quantum Noise
- 8.5.7 SNR
- 8.6 Non-ideal Detectors
- 8.6.1 SNR for a non-ideal Detector

- 9 Additional notes: "Lecture 2-additional.pdf"
- 9.1 Non-ideal Detectors
- 9.1.1 SNR for a non-ideal Detector
- 9.2 Optimization of X-ray Imaging: X-ray Spectrum

- 10 Additional notes: "Scattered Radiation and grids.pdf"
- 10.1 Motivation
- 10.2 Contrast
- 10.3 SNR
- 10.4 Causes of Scatter
- 10.5 Magnitude of Scatter
- 10.6 Methods of Reducing Scatter
- 10.7 Evaluation of Grids
- 10.7.1 Primary Transmission
- 10.7.2 Bucky Factor
- 10.7.3 Contrast Improvement Factor
- 10.8 Spatial Distribution of Scatter