Fall 2015

PHYS 6206

George E. Ioup
University of New Orleans

PHYS 6206 Image Restoration and Enhancement

Fall 2015: Wed and Fri, 11:00 AM – 12:15 PM, LA 250

References: Enders A. Robinson, 1980, Physical Applications of Stationary Time-Series, Macmillan; E. R. Kanasewich, 1981, Time Sequence Analysis in Geophysics, University of Alberta Press, Third Edition; Gerald M. Webster, editor, Deconvolution, 1978, Society of Exploration Geophysicists, Geophysics reprint series No. 1; Enders A. Robinson and Osman M. Osman, editors, Deconvolution 2, 1996, Society of Exploration Geophysicists, Geophysics reprint series No. 17; Peter A. Jansson, Deconvolution of Images and Spectra, 2nd edition, 1997, Academic Press; R.N. Bracewell, The Fourier Transform and Its Applications, McGraw-Hill, 3rd edition, 2000, or 2nd ed., revised, 1986; E.O. Brigham, The Fast Fourier Transform, Prentice-Hall, 1988, 1974; S. Lawrence Marple, Jr., Digital Spectral Analysis with Applications, Prentice Hall, 1987; Sophocles J. Orfanidis, Optimum Signal Processing: An Introduction, 2nd edition, S. J. Orfanidis, 2007

Class Day	Topics
1	Laplace transforms
2	Laplace transforms continued
3	Discrete Laplace transforms and z transforms
4	Fourier transform and convolutions, review
5	Correlations; stochastic processes; ergodicity
6	Special functions
7	Duration/bandwidth; stationarity
8	Power signals; Wiener-Khintchine Theorem, Blackman-Tukey power spectral estimation
9	Windows: rectangle, cosine bells, Hann, Bartlett, Hamming, Parzen
10	Windows: Blackman, Tukey, Gaussian, Chebyshev; Power spectral estimates: Daniell, Bartlett, Cooley-Lewis-Welch; prewhitening
11	Test 1
12	Minimum, maximum, mixed delay
13	Time series wavelets; review
14	Fourier deconvolution; polynomial deconvolution
15	Truncation approximation deconvolution

16	Least squares deconvolution
17	Levinson recursion for spiking and shaping filters; spiking with delay
18	Matched filters; output energy filters; review
19	Test 2
20	Van Cittert iterative deconvolution and Morrison iterative noise removal
21	Ioup iterative deconvolution; convergence properties
22	Autocorrelation estimation
23	Kawata/Ichioka iterative deconvolution
24	Minimum entropy deconvolution
25	Noise
26	Wiener filter in the transform domain
27	Deconvolution applications
28	Deconvolution applications
29	Deconvolution applications
30	Review
31	Test 3 (final exam)

Course Grade

Exam	1	27.5%
	2	27.5
	3	27.5
Project		9.0
Homework		8.5

George E. Ioup SC 1015 geioup@uno.edu
Juliette W. Ioup UNO (504) 280 6715 or 6341 or 6705
Department of Physics
University of New Orleans Fall 2015
Office hours: 1-3 Tues Thurs, 2-3 Mon Fri, any other time available and by appointment

Student Learning Outcomes

* Understand the z transform and its relation to the Fourier transform
* Understand the basic concepts of windowing in the time and frequency domains
* Understand wavelets and their factorization
* Understand the basic concepts of several techniques of deconvolution
* Know how to solve problems related to these topics

Academic dishonesty will not be tolerated. UNO Judicial Code is available online at http://www.studentaffairs.uno.edu/studentpolicies/policymanual/academic_dishonesty.cfm

Attendance Policy

Attendance will be monitored for every class. The total number of points (from tests, homework, and projects) earned by each student will determine the final grade.

Prerequisites
PHYS 6205 or consent of instructor

Students are expected to conduct themselves according to the UNO Student Code of Conduct, available online at http://www.studentaffairs.uno.edu.

Academic integrity is fundamental to the process of learning and evaluating academic performance. Academic dishonesty will not be tolerated. Academic dishonesty includes, but is not limited to, the following: cheating, plagiarism, tampering with academic records and examinations, falsifying identity, and being an accessory to acts of academic dishonesty. Refer to the UNO Student Code of Conduct for further information. The Code is available online at http://www.studentaffairs.uno.edu.

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