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University of New Mexico, Albuquerque  
Department of Electrical & Computer Engineering  
**ECE-595: Spatial Array Processing**  
Fall Semester 2006, 3 Credit Hours

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## Objective

The intent of this course is to introduce the student to the concept of sampling a space-time waveform in both time and spatial domains. More specifically the objectives of this course are:

1. to introduce concepts of spatial array processing, beam-forming, and space-time filtering,
2. to transfer existing knowledge in time-domain signal processing to spatial processing
3. to study applications of these array processing concepts in areas of interest in wireless communications and radar related processing.

## Synopsis

In this course, we will be looking at the notion of space-time processing of information as opposed to just traditional time-domain processing. We will specifically look at the following areas of interest:

1. Space-time model: wave equation, plane waves, four-dimensional Fourier transform, random fields, resolution, sampling, spatial aliasing, beam pattern synthesis, spatial spectrum analysis, wavenumber-frequency response, filtering in wavenumber-frequency space.
2. Beam-forming: delay-sum beam-forming, DFT domain beam-forming, maximizing array gain.
3. Subspace methods: spatio-temporal covariance matrix, signal and noise subspaces, MVDR, MUSIC, EV, linear predictive methods, singular value decomposition, sparse arrays, effect of coherent interference and subarray averaging.
4. Adaptive antenna arrays: Frost beam-former, adaptive nulling, constrained LMS, blocking matrix techniques, beam-space adaptation, RLS-based array processing.
5. Applications: radar, wireless communications, geophysics, medical.

## COURSE INFORMATION:

Course Instructor	Prof. Balu Santhanam
Office Location	Room 326A, ECE Bldg.
Contact Info	Email: <a href="mailto:bsanthan@eece.unm.edu">bsanthan@eece.unm.edu</a> Tel: (505) 277-1611 , Fax: (505) 277-1439
Prerequisite	ECE-439, ECE-340, linear algebra, working knowledge of MATLAB
Location	ECE-210
Lectures	TR: 3:30-4:45 PM
Textbook	Array Signal Processing: Concepts and Techniques D. H. Johnson and D. E. Dudgeon Prentice Hall Inc., Upper Saddle River, New Jersey, 1993.
Office Hours	TBA
TA	TBA
Contact Info	TBA

## GRADING SCHEME:

Problem Sets/Computer Projects : 30%  
Midterm Exam: 30%  
Final Exam : Dec 14, Thurs, 3:00 - 5:00 PM : 40%