13th National Conference on Communications (NCC 2007) January 26-28, 2007
Indian Institute of Technology, Kanpur
Registration *cum* Accommodation Request Form

Please fill this page and send it along with the bank draft to
Mr. Ajay Srivastava, Dept. of Electrical Engg., IIT Kanpur, Kanpur-208016, India.

1. **Name** _____ **Gender:** Male / Female
2. **If you are a student, specify the degree you are pursuing: Bachelors / Masters / PhD (Please tick one)**
   Institute & Place: _____
3. **Landline:**_____**Mobile**_____**Fax:**_____**E-mail:**_____
4. **If author (others may skip this section):**
   a. **Paper Number** _____
   b. **Title of the Paper:** _____
      _____
   c. **Biography:** Please e-mail a brief biography of the presenting author to ncc@iitk.ac.in at the earliest. Keep the paper number as the subject of the e-mail.

5. Registration Fees:

Participation Category	Conference Only	Additional amount for each tutorial (max. two)	**Registration Information**
Regular Participant	Rs. 3000/-	Rs. 700/-	*Registration Fees includes* . Dinner on 26th Jan. . Lunch and Dinner on 27th Jan. . Lunch on 28th Jan. . Tea / Coffee during session breaks . Conference Proceedings (Softcopy) All participants other than students will also get a hardcopy of the proceedings.
Student Participant	Rs. 700/-	Rs. 150/-	
Participant Paying in Foreign Currency	US $ 100	US $ 25	

6. Registration for tutorials (encircle your choices; do not encircle more than one within a group):
*Group **'A'**:* T1 T2 T3 *Group **'B'**:* T4 T5 T6
(Details about the tutorials are given in the following pages. All the tutorials will be held on **26th Jan**)

Amount being paid for tutorials: Rs._____

7. Total amount (= Registration Fees + Tutorial Fees): Rs._____
(As an example, for a student participant wishing to register for tutorials T1 & T6, the total amount will have to be Rs.1000/-. If the student wishes to register for only one tutorial, it'll be Rs.850/- and in case the student does not wish to attend any of the tutorials, the total amount will be Rs.700/-)

8. Accommodation Booking* (charges for this will be payable during your stay in the campus)
In case accommodation is required, please specify: **(Others, please skip this section)**
Date of Arrival: **Date of Departure:**
Accommodation is guaranteed for all participants, whose registration form is received by 29th Dec, 2006.

9. Payment:

Amount Enclosed		Please make the draft in favour of "**NCC 2007"** payable at Kanpur.
Demand Draft No.		
Date of Issue		
Name of Bank (with Location)		

* Accommodation Charges: In the Institute guest house (Visitors' Hostel): Rs.120 to 260/- per day (each room can accommodate two persons)
In Boys/Girls Hostels: Rs.30/- per day

Information Regarding Tutorials

A participant may choose to attend a maximum of two tutorials, not more than one from each of the two groups: Group A and Group B. All the tutorials listed under Group 'A' (T1, T2 & T3) will be conducted in parallel from **10:30 A.M. to 1:45 P.M.** and those listed under Group 'B' (T4, T5 & T6) will be conducted in parallel from **2:30 P.M. to 5:45 P.M. on 26th January, 2007.**

Group 'A': 10:30 A.M. to 1:45 P.M. (With a break of 15 minutes in between)

- **T1**

Title **Wireless System Evolution: Heterogeneous networks and convergence**

Speakers and affiliation: Dr. Manoj Choudhary, Texas Instruments, India.
Balaji S. Holur, Texas Instruments, India.

Summary: The tutorial will focus on the evolution of heterogeneous wireless systems, convergence requirements and approaches to their interworking. Based on coverage, mobility and supported data rates, wireless systems can broadly be classified into wireless cellular networks (e.g.2G/3G, long term evolution), wireless metropolitan area networks (e.g. IEEE family of 802.16, WiMAX), wireless local area networks (e.g. IEEE family of 802.11) and wireless personal area networks (e.g. Bluetooth, Ultra Wide Band).

Each of these systems has unique design criteria and system challenges. Starting with wireless communication theory, the tutorial will cover design and evolution aspects of these heterogeneous wireless systems. Systems will be explained with respect to physical layer, medium access layer, network mobility and main application considerations. Current state of art in the industry products for these systems will also be dwelt upon.

Multiplicity of these heterogeneous networks and their overlay in our daily life (e.g. at home, office) are leading to increasing requirements on their interworking and convergence. Scenario based interworking will be depicted and ongoing work in various standard forums for achieving convergence will be discussed.

- **T2**

Title **Introduction to Large Vocabulary Continuous Speech Recognition**

Speaker and affiliation: Dr. S.Umesh, Department of Electrical Engineering,
Indian Institute of Technology Kanpur, India.

Summary: In this tutorial, we will cover the basic blocks in a Large Vocabulary Continuous Speech Recognition system (LVCSR). The goal of this tutorial is to provide the theoretical and practical aspects in building a state-of-the-art large vocabulary continuous speech recognition system. The tutorial will discuss in detail the various blocks in a LVCSR including:

(a) Feature extraction: Mel-frequency cepstral coefficients and Perceptual Linear prediction (PLP) cesptral coefficients
(b) Discriminant Analysis and Linear Transformations.
(c) Basics of Hidden Markov Modeling
(d) Model training: Forward-backward algorithm, Baum-Welch re-estimation
(e) Triphone Modeling and Decision-tree state clustering
(f) N-gram language models
(g) Adaptation and Normalization for robustness to channel and speaker variations.

Finally, as an example, we will discuss a LVCSR system that was built for the evaluation of American Broadcast News as a part of the U.S. DARPA/NIST speech-to-text evaluation.

- **T3**

Title **Channel Estimation for OFDM and OFDMA : From the Ridiculous to the Sublime**

Speakers and affiliation: Dr. K.Giridhar, Sheetal Kalyani, and M.R.Raghavendra,
Department of Electrical Engineering, IIT Madras, India.

Summary: Orthogonal Frequency Division Multiple Access (OFDMA) along with multiple transmit and receive antennas techniques are expected to be the basis for future mobile and broadband wireless access systems. While much is expected from the frequency diversity and flexibility offered by OFDM and OFDMA techniques, the various performance measures can be severely affected if proper synchronization and accurate channel estimation methods are not employed at the receiver.

The focus of this tutorial is on channel estimation and tracking in OFDM and OFDMA systems, and to showcase some of the new solutions developed by IIT Madras. We will show how poorly designed channel estimation schemes can result in irreducible bit error rate (BER) floor even if powerful error control codes are applied. By using mathematical theories appropriate to the problem at hand, it is possible to design channel estimators which provide a significant performance gain over existing approaches without incurring high computational cost. The tutorial is divided into three parts, roughly based on the material to be covered by the three speakers.

Part 1 will give an overview of channel estimation techniques used for fading OFDM channels, and discuss popular approaches such as FFT-based interpolation in tandem with Kalman filter based tracking. In re-use 1 cellular OFDMA systems, the co-channel interference on the pilot-subcarriers can highly degrade the accuracy of such pilot-aided channel tracking (PACT) schemes. We show that if accurate channel estimates are available in a receiver with antenna diversity, the BER on the data-subcarriers can be reduced by employing interference nulling rather than maximal ratio combining.

Part 2 of the tutorial will consider parametric channel estimation algorithms which exploit the fact that the wireless channel can be parametrized as a combination of paths, each characterized by a delay and a complex gain. The wireless channel is said to be sample-spaced when the multipath delays are integer multiples of sampling period, and is otherwise considered to be a non-sample-spaced channel. Initially, we describe a parametric channel estimator using a model-order estimation rule which is suitable for sample-spaced channel models. However, this suffers from an interpolation error floor when used for non-sample-spaced channel models. We then present a general parametric channel estimation algorithm based on subspace filtering which exploits the structure in the second-order statistics of the pilot channel estimates. This algorithm is extended for "tile-based" parametric channel estimation applicable for uplink OFDMA as well. We also study the mean squared error and uncoded BER performance of the proposed algorithms.

Finally, Part 3 will address the issue of pilot-less channel tracking in fast fading OFDM channels. We treat decision directed channel tracking (DDCT) in mobile OFDM systems as an outlier contaminated Gaussian regression problem, where the source of outliers are the incorrect symbol decisions. It is possible to use generalized M estimators for decision directed estimation and apply extreme value theory in conjunction with the Huber's cost function for outlier detection and downweighting. The proposed estimators clearly outperform the 2D-MMSE and the EM based DDCT approaches in terms of simulated error rate performance at high fade rates. These estimators also have performance comparable to (or better than) pilot assisted Kalman filter based channel tracking schemes with only a modest increase in complexity. Thus, a 6% to 12% increase in symbol-rate is obtained without any loss in performance when compared to the PACT approaches, even when DDCT is applied over frame durations experiencing 2 to 3 entire fade cycles.

Group 'B': 2:30 P.M. to 5:45 P.M. (With a break of 15 minutes in between)

- **T4**

Title **QoS in 802.16 Wireless Broadband Access Networks: The Role of MAC, Cross-Layer Design, and Scheduling**

Speaker and affiliation: Dr. Abhay Karandikar, Department of Electrical Engineering, Indian Institute of Technology Bombay, India.

Summary: The main theme of this tutorial will be to elucidate medium access control (MAC) layer operation and cross-layer design techniques for providing quality-of-service (QoS) in wireless broadband networks. We will use the recently approved IEEE 802.16 standard as an example, for two important reasons:

-- The rich feature-set it presents, and the flexibility it provides the system/network designer in choosing various schemes for scheduling traffic, while accounting for interactions between an advanced PHY (physical layer) and the corresponding MAC (data link).

-- Growing interest from operators worldwide in this emerging technology, due to the prospects of using it in a variety of applications, such as wireless data backhaul or in regions of the world where there is little or no wired infrastructure.

The IEEE 802.16 standard for fixed and mobile wireless broadband access systems is a complex standard with many features to enable data services over BWA links. These include, for instance, longer range (of 10s of miles), advanced coding and modulation schemes (OFDM, OFDMA) and power control at the physical layer, and the definition of traffic classes and advanced automatic-repeat request (ARQ) schemes at the MAC layer, to name a few.

From a traffic scheduling perspective, one must understand the key features of the standard that relate to QoS at the MAC layer, and develop a range of alternative QoS architectures that can provide the required performance. It also requires developing insights into the role/functions of the principal components of these architectures. For example, base-station (BS) or subscriber-station (SS) schedulers, traffic request classifiers, contention estimators, and so on.

With this perspective, the specific topics to be addressed in our tutorial include:

i. Introduction to the 802.16 wireless broadband standard – the 802.16 protocol stack; key features of the PHY and MAC layers
ii. MAC layer details – packing/fragmentation, QoS, ARQ schemes
iii. Scheduling services (or traffic classes) in 802.16, and their relation to QoS
iv. Role of cross-layer design – benefits, pitfalls, recommended practices
v. Scheduling schemes for service guarantees in 802.16-based networks; presentation of initial performance results of selected schemes, and open issues
vi. Cross Layer scheduling for OFDMA

Continued …

- **T5**

  Title **Video based Surveillance**

  Speaker and affiliation: Dr. Subhashis Banerjee, Dept. of Computer Science and Engineering, Indian Institute of Technology Delhi, India.

Summary: In this tutorial we will discuss models and techniques required to build a scalable framework for activity recognition and visual surveillance using multiple cameras. To this end, we will specifically address the issues of

1. Multi-camera coverage of a wide area scene and issues in automatic calibration and registration of the cameras.
2. Reliable Object detection and tracking using multiple cameras.
3. Coordination of multiple cameras and data aggregation.
4. A generic framework for unsupervised or semi-supervised learning of usual patterns of activities in a scene and detection of deviant or unusual activities.

We will deal with issues in automatic surveillance of both sparse and dense situations.

- **T6**

  Title **Software-based RF Measurements**

  Speaker and affiliation: Mr. Abhishek Nag, National Instruments, Bangalore.

Summary: This tutorial covers material regarding understanding of RF Measurement Hardware. Attendees will learn the architecture of RF Vector Signal Generators and RF Vector Signal Analyzers. We will also discuss differences between vector signal generation and CW sources. We will discuss operation of digital up-conversion and digital down-conversion, which are typically found in current RF hardware. We will talk about common measurements for digital communications systems like EVM, Rho, MER etc. and their physical significance. We will also talk about software-defined radio and how advances in PC-based technology is enabling wide-range of users rapidly design, prototype and test emerging communication standards.

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