



### Tracing Traitors: Collusion Resistant Multimedia Fingerprinting

**K.J. Ray Liu, University of Maryland, College Park  
Dept. of Electrical and Computer Engineering**



Digital fingerprinting is an emerging technology for identifying users who have legitimate access to plaintext content but may use the content for unintended purposes, such as duplication and redistribution. For multimedia, fingerprints can be put into the content using embedding techniques that are typically concerned with robustness against a variety of attacks mounted by an individual. Ensuring the appropriate use of multimedia content, however, is no longer a security issue with a single adversary. The global nature of the Internet has brought media closer to both authorized users and adversaries. It is now easy for a group of users with differently marked versions of the same content to work together and collectively mount attacks against the fingerprints. These attacks, known as collusion attacks, provide adversaries a cost-effective method for removing an identifying fingerprint.

In this talk, tracing traitors using collusion-resistant fingerprinting for multimedia that jointly considers the encoding, embedding, and detection of fingerprints will be presented. A general formulation of fingerprint coding and modulation provides a unified framework covering orthogonal fingerprints, coded fingerprints, and other correlated fingerprints. Under this framework, we have proposed a new class of structured codes, known as Anti-Collusion Codes (ACC), and designed algorithms that allows for gathering forensic evidence of the guilt and for identifying colluders.

Professor K. J. Ray Liu received the B.S. degree from the National Taiwan University in 1983, and the Ph.D. degree from UCLA in 1990, both in electrical engineering. His research contributions encompass broad aspects of wireless communications and networking; information security; multimedia communications and signal processing; signal processing algorithms and architectures; and bioinformatics. Dr. Liu is a Fellow of IEEE. Dr. Liu is the Editor-in-Chief of IEEE Signal Processing Magazine and was the founding Editor-in-Chief of EURASIP Journal on Applied Signal Processing. Dr. Liu is a member of the Board of Governors and has served as Chairman of Multimedia Signal Processing Technical Committee of IEEE Signal Processing Society.

Place: Benedum Hall, Room 426, University of Pittsburgh  
3700 O'Hara St.  
Pittsburgh, PA  
Date: November 3<sup>rd</sup>  
Program: 12:00 Noon

For more information please contact Michael McCloud at [mmccloud@engr.pitt.edu](mailto:mmccloud@engr.pitt.edu).

### RFID Privacy: Challenges and Progress Burt Kaliski, RSA Security



Recent proposals for widespread deployment of Radio Frequency Identification (RFID) systems have raised significant concerns about consumer privacy. With current low-cost tag technology, these concerns are somewhat unavoidable, as the tags aren't designed to differentiate between authorized readers and unauthorized ones, and likewise the readers can't directly distinguish between tags they're allowed to scan and those they aren't. Moreover, the privacy risks for consumers translate directly into the potential for industrial espionage in supply-chain implementations, undermining the competitive advantages that businesses aim to realize by deploying RFID systems in the first place. In this talk, some of the recent research results in RFID privacy that attempt to address these concerns without significantly impacting the cost of the tags will be outlined.

Dr. Kaliski is chief scientist of RSA Security and director of RSA Laboratories, the research center of RSA Security. He has been involved extensively in the development of cryptographic standards, as a contributor, editor, and working group chair with particular emphasis on Public-Key Cryptography Standards (PKCS).

Place: 404 IS Building  
135 N Bellefield Ave.  
Pittsburgh, PA 15213  
Date: November 12<sup>th</sup>  
Program: 2:30 PM

For more information, please contact Prashant Krishnamurthy at (412) 624-5144 or [prashant@mail.sis.pitt.edu](mailto:prashant@mail.sis.pitt.edu).



## Industrial Power Systems: A Facilities Engineering Perspective

Barry Brusso, Fellow, IEEE  
IEEE Distinguished Lecturer



Typically the resident plant facilities engineering staff for an industrial facility are ultimately involved in the day to day on site performance, application, operation and maintenance of the plant power systems. It is critical to have this staff take the lead in planning, design, and preparation of specifications, installation oversight, and commissioning of new power systems. This presentation will focus on the role of the facilities engineers as the owner's representatives and the engineering steps they must follow to reach the project objectives associated with new and retrofitted industrial power systems.

Mr. Brusso received a B.S.E.E. degree from the University of Illinois (Champaign-Urbana) in 1967 and joined the Westinghouse Electric Corp. the same year. He joined Fidelity Electronics Ltd., in 1975 as Senior Engineer in the Biomedical Engineering Division, with overall responsibility for development and production of its products. In 1978, he joined the S&C Electric Company as Facilities Engineer in the Plant Engineering Division and presently holds the dual positions of Principal Facilities Engineer and Manager – Electronic Systems Support with overall responsibility for electrical engineering of the manufacturing facilities and design and fabrication of the product's quality inspection testing equipment. For over 21, years he managed the Metrology and Communication Systems Department, which maintains corporate standards and performs calibrations of the measuring and test equipment for the entire company. Mr. Brusso has served as a member-delegate to the National Conference of Standards Laboratories for over 10 years. He is an IEEE Fellow, recipient of the IEEE Third Millennium Medal and a member of the following IEEE Societies: Industry Applications, Dielectrics and Electrical Insulation, Instrumentation and Measurement, and Power Electronics.

Place: Westinghouse Energy Center, Monroeville  
Date: November 11<sup>th</sup>  
Social: 6:30 PM  
Program: 7:00 PM

This meeting will be of particular interest to the members of the PES and IAS societies. For more information or to register, please contact Dr. Kal Sen at (724) 696-1611 or [senkk@ieee.org](mailto:senkk@ieee.org).

Directions: From downtown Pittsburgh, take the Parkway East Outbound to Exit 14A (Monroeville). Cross the traffic light (Business 22) and proceed on Rt. 48 South for two traffic lights. Turn left onto Northern Pike. Proceed East ~ 0.2 miles and turn right at the first traffic light onto Westinghouse Drive. Travel 0.7 mile to the three flags where the main entrance is located. Parking in the evening will be plentiful in the large area in front of the building. Enter the main entrance. Check with the security inside. You will be directed to the proper auditorium for the presentation.

From PA Turnpike, take Exit 57 (Monroeville). After the toll plaza, get in the left lane (Business-22). At the first light, turn left on to Rt. 48 South and follow the directions shown above.

### SC2004 – High Performance Computing Networking and Storage Conference

SC2004, the world's leading conference on high performance computing, networking and storage, will be held in the brand new David L. Lawrence Convention Center in Pittsburgh from November 6-12. The SC2004 conference will bring representatives from many technical communities together to exchange ideas, celebrate past successes and plan for the future. To reflect this important function, the conference theme is Bridging Communities. This represents not only the technical communities participating in the conference but the architecture of the city, too. State-of-the-art technology will be utilized in the conference's high-performance network, SCinet, and in the Access Grid to bring participants from around the world to Pittsburgh. At the convention center itself, the Technical Program, Education Program, and Minority Serving Institutions Program will all create bridges to new communities.

The conference Technical Program will continue the tradition of providing high quality, peer reviewed papers in research and application areas of high performance computing, networking and storage. Papers are being presented from all communities including industry, DoD, federal agencies, and universities. The Technical Program will be the highlight of the conference. A total of 23 tutorials ranging from introductory to advanced concepts will be available. Additionally, there will be industry exhibits showcasing the latest technology available now that will be on the desktop in just a few more years, and research exhibits showcasing what's new in the university, federal government and not-for-profit sectors. The Exhibits provide the time and the place for real information exchange and can lead to new partnerships and ideas!

More details about the conference and information on how to register can be found at the conference website [www.sc-conference.org/sc2004](http://www.sc-conference.org/sc2004)

Place: David L. Lawrence Convention Center, Pittsburgh PA  
Date: November 6<sup>th</sup> - 12<sup>th</sup>

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## Tour of the Allegheny Power Operations Center



This tour will visit the Corporate Headquarters of Allegheny Power located in Greensburg, PA where the Allegheny Power System Operations Center is located. From this location, Allegheny Power System Operators and Dispatchers monitor both the transmission and distribution networks at voltages from 765kV down to service delivery voltages (120/240 volts) and responds to incidents that affect the ability of the system to maintain the reliability of service to the interconnected network and to its individual customers.

Allegheny Power uses two principal computer software tools to perform the monitoring and the analysis of events occurring on the system. Allegheny Power system operators use an Energy Management System (EMS) that is connected to substations connected to the sub-transmission and transmission networks (23kV through 765kV) via a Supervisory Control and Data Acquisition (SCADA) system. With the EMS, they monitor the current operating conditions that exist on the network and can remotely operate facilities to control, reconfigure or restore the system. EMS is a product developed by AREVA T&D (formerly ESCA).

Allegheny Power is a member of the East Central Area Reliability Council (ECAR) operating within the Eastern Interconnection. Allegheny Power is also a member company of PJM, which is a regional transmission organization that coordinates the movement of electricity in all or parts of 12 states and the District of Columbia.

Dispatching representatives use an Outage Management System (OMS) that inputs information from calls received by customers to predict the location of causes that interrupt the service to customers on the distribution (12kV) and service voltage (4kv to 120/240v) systems. From this information, the OMS provides a visual tool to the Dispatchers to help them direct restoration crews to the locations of those causes to affect repair efforts. OMS is a product developed by CGI.

Allegheny Power provides electric service to over 1.5 million customers in five states.

Place: Allegheny Power Corporate Headquarters  
800 Cabin Hill Rd.  
Greensburg, PA 15601  
Date: November 17<sup>th</sup>  
Program: 6:30 PM

For more information, or to register, please contact Dave Vaglia at (724) 733-6513 or [davevaglia@ieee.org](mailto:davevaglia@ieee.org) by November 10<sup>th</sup>.

Directions: From Pittsburgh, take I-376 East (Parkway East) towards Monroeville, and exit onto US-22 East. Follow US-22 east to Delmont. Take Route 66 South (portions toll) to Exit 9 Harrison City/Greensburg. Turn left at the traffic light and travel ~ 5miles on Business Route 66 South. At the 2<sup>nd</sup> traffic light, turn left onto Cabin Hill Drive. Allegheny Power is at the top of the hill.



## 2005 PES Chapter Outstanding Engineer Award

The Power Engineering Society of IEEE Pittsburgh Section is seeking nominations from local PES IEEE members for the 2005 PES Chapter Outstanding Engineer Award. The Outstanding Engineer Award is designed to recognize members of IEEE/PES Pittsburgh Chapter who have made outstanding contributions to their profession through their technical abilities. The nominees will be judged on the basis of their activities during the past two calendar years (2003 and 2004). Please submit your nominee or nominate yourself, by providing the following information:

Name, IEEE Membership Number, IEEE Grade, Professional Affiliation, Importance of technical contributions, Patents/Proprietary Designs/Papers/Technical Presentations, Description and years of technical distinction and responsibility, Service to IEEE, Service to the engineering profession outside IEEE, and Recognition through other honors.

Interested members should submit their nominations to the Committee Chair, Harry Hagerty, at [hhagerty@ieee.org](mailto:hhagerty@ieee.org) no later than December 31<sup>st</sup>. The decision of the Award Committee will be considered final. The winner will be acknowledged at the History Dinner in the spring.

## Graduates of the Last Decade IEEE Gold Program



Members in the Pittsburgh Section are interested in gathering support for an active GOLD group. Please respond with any ideas for programs. The GOLD group has a purpose of providing young engineers with the tools they need to succeed in life as well as in their profession. Use this information as guidelines for suggestions that you submit to the committee.

In process are plans for a social gathering in mid-November. The committee would like to hear ideas for and when to have this meeting. There are preliminary plans to meet at Dave and Busters for a brief meeting and social activities. Further details will be provided in the November Bulletin.

Please respond to Paul Link at (724) 387-4893 or [p.r.link@ieee.org](mailto:p.r.link@ieee.org).

## Practical Communication over Doubly-Dispersive Channels

Philip Schniter

Dept. of Electrical Engineering, The Ohio State University



For high-rate communication over channels with large delay-spread, orthogonal frequency domain modulation (OFDM) offers a spectrally efficient and computationally efficient solution. Focus will be on doubly-dispersive channels: those in which both delay-spreading and Doppler-spreading are non-negligible, i.e., where the inter-symbol interference (ISI) response is long and quickly varying. With these channels, OFDM experiences Doppler-induced inter-carrier interference (ICI) whose mitigation requires complicated processing that spoils its low-complexity advantage. In response, various researchers have proposed OFDM-like schemes which incorporate smooth pulses, with the goal of ISI/ICI reduction under low computational complexity. Typically the pulses are designed for maximum ICI/ISI suppression subject to a (bi-)orthogonality constraint, i.e., a constraint that zero interference occurs in trivial channels. For good ISI/ICI suppression, however, the spectral efficiency of these (bi-)orthogonal systems must be compromised.

A different paradigm for multicarrier pulse design is proposed. Assuming that the transmitter knows the channel fading statistics (but not the channel realization), we design jointly-SINR-optimal pulses for ISI/ICI shaping rather than ISI/ICI suppression. Since the focus is on non-trivial channels, pulse (bi-)orthogonality need not be enforced. The target ISI/ICI profile is designed to facilitate high-performance/low-complexity interference suppression. Two low-complexity iterative soft interference-cancellation algorithms are proposed which leverage the resulting ISI/ICI structure, one based on the MSE criterion and the other based on the ML criterion. Simulations indicate a detection performance close to the matched filter bound, at least for small constellations. These algorithms with a soft-input soft-output decoder in a "turbo" equalization scheme.

Results suggest that, when operating over significantly spread channels, max-SINR systems designed for ISI/ICI-shaping can achieve higher outage capacity than those designed for ISI/ICI-suppression. Outage capacity analysis is also used to obtain rough design guidelines (for, e.g., symbol interval, carrier spacing, ISI/ICI target width) since traditional multicarrier design guidelines do not translate directly to the ISI/ICI-shaped paradigm.

Mr. Schniter received his bachelors and his masters degrees from the University of Illinois at Urbana-Champaign, and his doctorate from Cornell University. Presently, he is an Assistant Professor in the Department of Electrical Engineering at The Ohio State University. His areas of research include signal processing for communication systems and wireless sensor networks, especially in the design of practical communication receivers for doubly-dispersive channels.

Place: Benedum Hall, Room 360  
University of Pittsburgh, Oakland  
Date: November 18<sup>th</sup>  
Program: 2:00 PM

For more information, please contact Michael McCloud at [mmccloud@engr.pitt.edu](mailto:mmccloud@engr.pitt.edu).



## Mitigating the Effects of Voltage Sag and Flicker on Distribution Lines with Solid-State Switched Capacitors

Chris Sermon, P.E.  
Power Quality Systems, Inc.



Residential, commercial, and industrial growth along long distribution feeders has increased the awareness and impact of poor power quality events such as voltage sag and flicker. Voltage sag and flicker can have a commercial and economic impact on both suppliers and users of electric power.

The distribution-class Static VAR Compensators (SVC) provides an economical and field proven solution to the problems of voltage sag and flicker. This presentation will provide an overview of the distribution-class SVC including power and control implementations, application considerations and application examples.

Mr. Sermon graduated from Georgia Institute of Technology with both a Bachelors and Masters in Electrical Engineering. Currently, he works for Power Quality Systems in West Mifflin as a Senior Engineer. Chris is a member of the IEEE and a Registered Professional Engineer in the Commonwealth of Pennsylvania.

Place: Westinghouse Energy Center, Monroeville  
Date: December 9<sup>th</sup>  
Social: 6:30 PM  
Program: 7:00 PM

This meeting will be of particular interest to the members who belong to the PES and IAS societies. For more information or to register, contact Dave Vaglia at (724) 733-6513 or [davevaglia@ieee.org](mailto:davevaglia@ieee.org) by December 2.

For directions, please refer to the article on page 2.



## Current Issues and Problems in Distributed Generation

Joseph L. Koepfinger, Life Fellow, IEEE  
IEEE Distinguished Lecturer



The conversion of energy has existed since the earliest days of civilization. With the discovery of electrical energy, there has been a constant evolution of technology to convert all forms of primary energy into electricity. Most forms of energy can be stored and used when needed. Storage of electricity is possible and is suitable economically for some applications. The current usage of the electrical transmission and distribution system is designed for the conversion of some primary form of energy to direct utilization. In some instances, electrical energy is stored by converting it to another form, such as chemical energy as in a battery or hydro energy as in pump storage. Today, some energy can be stored in an electric form in capacitors and by the use of super magnetic storage. The demand for electrical energy is rarely constant since it has to follow the needs of the user. The electrical power system as it is known today in the industrially developed countries started as a distributed generation. The need to be able to supply electrical energy on demand caused the evolution of small, isolated generating facilities, into an interconnected power system with the generation usually being located near the source of the primary energy such as coal, hydro and liquid fuels.

As the large interconnected facilities developed, there became a trade off between capacity and reliability. Some planning criteria were developed to define an acceptable level of service for the price being paid for the product, such as limit on the number of outages per year and the duration for different types of customers and different density of customers. These limits are arbitrary and do not provide the customer the opportunity to make a choice on his/her quality of service.

Deregulation of the power industry is changing the playing field and providing customers new opportunities to have more input into the type and quality of their electric service. This is providing an opportunity for the re-birth of distributed energy resources (DER) or distributed resources (DR). The development of the modern DR and its utilization is taking many forms. Some are being operated to back up existing electrical facilities, others are the prime source of electricity, operating individually or in a microgrid and others are being operated as an integral part of the existing electric supply system.

This tutorial will review the evolution of DR, the types of DR and their characteristics, the problems and requirements associated with operations in a microgrid and in the integration with an existing electrical system. Consideration will be given to operation limitations, protection, control, communications and safety issues. There will be a discussion of some typical installations such as combined cycle installation and efficiencies. Some material will address the problems associated with the interconnection of DR on electrical power distribution systems. Key to the success of the discussions will be the understanding of the terminology by all of the participants, including the instructor.

The tutorial will focus on the recent development of IEEE 1547.1 Interconnection of DR and other standards under development in the 1547 series of standards. This will be an interactive tutorial where the participants will have an opportunity to raise issues and have them discussed by the participants.

Place:	Westinghouse Energy Center, Monroeville
Date:	December 2 <sup>nd</sup>
Social:	6:30 PM
Program:	7:00 PM

This meeting will be of particular interest to the members who belong to the PES and IAS societies. For more information or to register, please contact Dr. Kal Sen at (724) 696-1611 or [senkk@ieee.org](mailto:senkk@ieee.org) by November 29<sup>th</sup>.

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### Future City Pittsburgh Volunteers Needed

The Pittsburgh Region is beginning its sixth year in the National Future City Competition. The number of Middle Schools that have registered in the Pittsburgh Regional Competition has grown each year. The Competition's growth is testimony to the program's unique capacity to challenge students to learn and test new concepts related to engineering and city planning, to apply the mathematics and science they have already learned, to explore their imaginations about what our cities will be like in the future, and to build an example of the result using ingenuity and their own hands. However, another important facet of the Pittsburgh Regional Future City Competition that has allowed it to expand is the associated growth of a cadre of dedicated volunteers. Without volunteers, there would be no competition.

Please, volunteer as a Presentation Aide or Judge. During November and December, judges will review the SimCity files and essays. On Saturday, January 15, 2005 the Pittsburgh Regional Competition will be held at the Carnegie Music Hall in Oakland. Based on past experience we anticipate that we will need more than 120 volunteers to fill the positions of Essay Judges, Disk Judges, Registrars, Model Movers, Room Manager/Timers, Score Keepers, Special Awards Judges, Presentation Judges, Exhibit Area Control Volunteers, Still and Video Camera Operators, and Public Relations Coordinators. Our goal is to identify all volunteers, and make assignments by January 2, 2005. Orientation Meetings for Presentation Aides and Judges will be held as needed in early January.

Please add Your Name to Our 2004-2005 Volunteers List. We welcome the help of anyone who is interested in volunteering his or her time. To qualify as a Presentation Judge, you must have judged before or have attended a Judge Orientation Meeting. If you are interested in registering as a volunteer for the 2005 Future City Competition please take a minute and fill out the Volunteer Registration Form at [http://www.futurecitypittsburgh.org/futcityvolunteer\\_form.htm](http://www.futurecitypittsburgh.org/futcityvolunteer_form.htm).

If you have any questions, call Bill Pruss at (412) 273-7100.

