Advance Program

Optical Code Division Multiple Access: Applications & Devices

Monday, 20 July 2009

ALL SESSIONS WILL BE HELD IN CARDIFF

3:30 PM - 5:00 PM

Session MA1: OCDMA SYSTEMS I
Session Chair: Gabriella Cincotti, *Università degli Studi Roma Tre, Rome, Italy*

MA1.1 3:30 PM - 4:00 PM (Invited)

Full-Duplex, 10Gbps OCDMA System, N. Kataoka*, National Institute of Information and Communications Technology, Tokyo, Japan*

We review a full-duplex, 10Gbps DPSK-OCDMA system including OCDMA/WDM system configuration, hybrid multi-port and SSFBG encoding/decoding devices, OCDMA prototype, and demonstrations.

MA1.2 4:00 PM - 4:30 PM (Invited)

Performance of Asynchronous Time-Spreading and Spectrally-Coded OCDMA Systems, S.-G. Park*, Hanyang University, Seoul, Korea* and A. M. Weiner*, Purdue University, West Lafayette, IN, USA*

The performance of asynchronous coherent time-spreading OCDMA systems is evaluated semi-analytically and the results are compared with those of spectral coding OCDMA systems using ultra-short pulses. The fundamental multi-access interference limited performances are predicted to be identical.

MA1.3 4:30 PM - 4:45 PM

10G-PON Over OCDMA Uplink using Hybrid SSFBG Encoder/Multi-port Decoder and 10 Gbps Burst-mode Receiver, S. Yoshima*, Mitsubishi Electric Corporation, Kanagawa, Japan*, N. Nakagawa*, Osaka University, Osaka, Japan*, N. Suzuki, M. Noda, M. Nogami, J. Nakagawa*, Mitsubishi Electric Corporation, Kanagawa, Japan* and K.-I. Kitayama*, Osaka University, Osaka, Japan*

We propose and experimentally demonstrate a novel 10G-PON over OCDMA uplink burst transmission by using hybrid SSFBG encoder/multi-port decoder and 10 Gbps burst-mode receiver, which can achieve four times larger capacity than conventional 10G-PON.

MA1.4 4:45 PM - 5:00 PM

On the Capacity of SOA-assisted SAC-OCDMA Systems: A Numerical Approach using Multicanonical Monte Carlo, A. Ghazisaeidi, and L. A. Rusch*, Université Laval, Québec City, QC, Canada*

We propose an accurate, computationally efficient numerical model for noise mitigation in SAC-OCDMA. We validate our results with previously reported experimental results, and probe via simulation the limits of this noise suppression technique.

Tuesday, 21 July 2009

9:00 AM - 10:00 AM

Session TuA1: OCDMA SERVICE
Session Chair: Xu Wang, *Heriot-Watt University, Edinburgh, Scotland, UK*

TuA1.1 9:00 AM - 9:30 AM (Invited)

Truly-Asynchronous, Scalable and Survivable Optical CDMA Networks with Heterogeneous QoS, P. R. Prucnal, M. P. Fok, K. S. Kravtsov, Z. Wang and Y. Deng*, Princeton University, Princeton, NJ, USA*

All-optical processing technologies, including all-optical thresholding, noise suppression, and autocorrelation peak detection, are shown to enhance the performance of incoherent optical CDMA networks. A truly-asynchronous optical network with flexible quality-of-service and self-healing capability is demonstrated.

TuA1.2 9:30 AM - 10:00 AM (Invited)

Transmission Approaches for Services of Variable-Bit-Rate and Differential QoS using OCDMA, H. Yin*, Dalian University of Technology, Dalian, China* and W. Liang*, OEwaves, Inc., Pasadena, CA, USA*

We discuss the transmission approaches for services with different bit-rate and diverse QoS in photonic CDMA networks. The proposed two-dimensional variable-length and variable-weight optical orthogonal codes can support variable bit-rate and differentiated QoS.

10:00 AM – 10:30 AM **COFFEE BREAK**

10:30 AM - 11:45 AM

Session TuA2: OCDMA Security
Session Chair: Ken-ichi Kitayama, *Osaka University, Osaka, Japan*

TuA2.1 10:30 AM - 11:00 AM (Invited)

Multiple Secure Virtual Private Networks over Passive Optical Networks using Electronic CDMA, T. Nirmalathas, *University of Melbourne, Victoria, Australia*, N. Nadarajah, *National ICT Australia, Melbourne, VIC, Australia* and E. Wong, *University of Melbourne, Melbourne, VIC, Australia*

In this paper, we present the experimental investigation of the use of electronic code division multiple access technique to achieve multiple secure virtual private networks over passive optical network architecture. We also discuss the scalability of this technique using analytical modelling.

TuA2.2 11:00 AM - 11:15 AM

On the security of spectrally encoded quantum-encryption protocols, G. Cincotti, *Università degli Studi Roma Tre, Rome, Italy*

The confidentiality of the spectral implementation of the Y00 quantum encryption protocol is investigated, against ciphertext only and known plaintext attacks. A generic framework is proposed for developing a secure encryption scheme based on a single multiport encoder/decoder.

TuA2.3 11:15 AM - 11:30 AM

On the Security of OCDM-based Encryption Against Key-Search Attacks, G. Di Crescenzo, R. Menendez and S. Etemad, *Telcordia Technologies, Inc., Piscataway, NJ, USA*

Monte-Carlo simulations of the effectiveness of key-search attacks on OCDM-based encryption reveal that proper code scrambling can result in codes that obscure one another and are resilient against iteratively improving an attacker's key guesses.

TuA2.4 11:30 AM - 11:45 AM

A Scrambling Technique to Enhance OCDMA Network Confidentiality, V. Sacchieri, *University of Rome 3, Rome, Italy*, P. Teixeira, A. L. J. Teixeira, *University of Aveiro, Aveiro, Portugal* and G. Cincotti, *Università degli Studi Roma Tre, Rome, Italy*

An all-optical method to enhance confidentiality in optical networks is presented. Security of a P2P OCDMA transmission is analyzed, where data are scrambled by a cascade of encoders, so that the decryption difficulty is increased.

12:00 PM – 1:30 PM **LUNCH BREAK**

1:30 PM - 3:00 PM

Session TuA3: OCDMA Devices & Techniques
Session Chair: Shahab Etemad, *Telcordia Technologies, Inc., Red Bank, NJ, USA*

TuA3.1 1:30 PM - 1:45 PM

Demonstration of Time-Domain Spectral Phase Encoding/DPSK Data Modulation using Single Phase Modulator, X. Wang, Z. Gao, *Heriot-Watt University, Edinburgh, Scotland, UK*, N. Kataoka and N. Wada, *National Institute of Information and Communications Technology, Tokyo, Japan*

We proposed and experimentally demonstrated time-domain spectral phase encoding scheme using single phase modulator for 8-chip, 20GHz/chip optical code generation and 2.5 Gbps DPSK data modulation, and successfully transmitted and decoded the data with BER<10^{-9}.

TuA3.2 1:45 PM - 2:15 PM (Invited)

Optical Wireless CDMA Employing Solid State Lighting LEDs, T. Schenk, L. Feri, H. Yang and J.-P. M. G. Linnartz, *Philips Research Laboratories, Eindhoven, The Netherlands*

We show that optical wireless CDMA can successfully be applied for visible light communication with power LEDs. We detail how it meets the requirements of multiple access communication, particularly for positioning and illumination sensing.

TuA3.3 2:15 PM - 2:30 PM

Experimental Demonstration of Electronic GVD Compensation in Optical CDMA Networks, M. N. Pimenta and I. Darwazeh, *University College London, London, UK*

We experimentally demonstrate an electronic GVD compensator for multi-wavelength Optical CDMA systems. The compensator uses a distributed transversal filter proposed in the context of Optical Communications. Results show improvement in the ability to detect the autocorrelation peak in presence of Multi-Access Interference.

TuA3.4 2:30 PM - 2:45 PM

Asynchronous Detection with Clock and Data Recovery in Optical CDMA Networks Using Dispersion-Imbalanced Loop Mirror, Y. Deng, *Princeton University, Princeton, NJ, USA*

We experimentally demonstrate asynchronous detection of optical CDMA signals with a dispersion-imbalanced loop mirror, which makes the signals compatible with off-the-shelf CDR unit by removing multiple-access interference and interferometric noise.

TuA3.5 2:45 PM - 3:00 PM

Impact of Four Wave Mixing on 2-D Optical Code-Division Multiplexing Systems, N. T. Dang and A. T. Pham, *University of Aizu, Aizuwakamatsu, Fukushima, Japan*

This paper theoretically analyzed the impact of FWM on 2-D OCDM system performance considering various noises, interferences, and system's parameters. Specifically, the impact on the operational power range, power penalty is quantitatively analyzed and discussed.

3:00 PM – 3:30 PM **COFFEE BREAK**

3:30 PM - 4:45 PM

Session TuA4: OCDMA Systems II
Session Chair: Naoya Wada, *National Institute of Information and Communications Technology, Tokyo, Japan*

TuA4.1 3:30 PM - 3:45 PM

Code/Pulse Position Swapping (C/PPS) for Multiple-Bits/Symbol and Reconfigurable Multiple Access Communications, A. J. Mendez, *Mendez R&D Associates, El Segundo, CA, USA*, V. J. Hernandez, *Lawrence Livermore National Laboratory, Livermore, CA, USA*, R. M. Gagliardi, *University of Southern California, Los Angeles, CA, USA* and C. V. Bennett, *Lawrence Livermore National Laboratory, Livermore, CA, USA*

An architecture for code/pulse position swapping (C/PPS) is described, whereby code modulation replaces traditional pulse position modulation (PPM). The architecture supports M-ary signaling, multiple accessing, throughput vs. QoS trade-offs, and granular data rates.

TuA4.2 3:45 PM - 4:15 PM (Invited)

Beat-Noise-Tolerant Gigabit/s O-CDMA Technique Using Spectral Amplitude Coding of Coherent Multi-Frequency Light, S. Kaneko, H. Suzuki, N. Miki, H. Kimura and K. Kumozaki, *NTT Corporation, Chiba, Japan*

We present two gigabit/s spectral-amplitude-coding O-CDMA techniques that use coherent multi-frequency light. The techniques achieve high beat-noise tolerance by either employing multi-frequency self-homodyne detection or using spectral M-ary ASK based on electrical-domain spatial-code spreading.

TuA4.3 4:15 PM - 4:45 PM (Invited)

Coherent Spectral Phased Coded OCDM Systems: Progress in Spectral Efficiency and Long-Distance Transmission, P. C. Toliver, A. Agarwal, R. Menendez, J. L. Jackel and S. Etemad, *Telcordia Technologies, Inc., Red Bank, NJ, USA*

We review recent developments in coherent, spectral phase coded optical code-division multiplexed (OCDM) systems employing integrated ring-resonator based coding technologies. We describe progress in advanced modulation formats for improved spectral efficiency and long distance transmission.

End of Program