COURSE ON VISIBLE LIGHT COMMUNICATIONS (VLC)

Prof. Dominic O’Brien
Oxford University, UK

November 22nd, 2013

Course schedule and venues: 22 Nov 9:00-16:00 in TS 127 (Tietotalo, University of Oulu)

Target audience: PhD students, faculty members, R&D industry professionals

ECTS: For those interested in obtaining credits from this course, an additional seminar work and seminar day will be organized.

Course host at DCE: Marcos Katz

Objectives

The course provides an introduction to optical wireless communications, with particular emphasis on visible light communications.

Course contents

1. Introduction to optical wireless and visible light communications (VLC)
   1.1 System overview

LOS
1.2 Sources
Lasers
Characteristics
Eye safety
Driving strategies
Beamshaping
LEDs
Characteristics
Eye safety
Driving strategy
Beamshaping

1.3 Channel
Line of sight
Characteristics
Model
Diffuse
Characteristics
Model
Measurements
Channel impairments
Ambient light

1.4 Receiver
Receiver overview
Optical systems
Photodetector and amplifier
Performance calculations
SNR estimation
Impairments
Ambient light
Amplifier noise
Advanced receiver geometries
Imaging receivers
Angle diversity
MIMO receivers

1.5 Link models

LOS

Single channel link model

Diffuse

Single channel link model

2. System examples: VLC

1.6 The challenge of high speed

Equalisation

OFDM

MIMO

MIMO OFDM

1.7 IR examples: a comparison

OMEGA demonstrators

Beamsteering approaches

3. Design example: single channel VLC link

1.8 Transmitter

Modelling intensity at receiver

1.9 Receiver

Estimating sensitivity and BER

1.10 Implementation

Electronics

Optics

4. VLC applications, developments and challenges

1.11 Applications

1.12 Technical challenges
1.13 Non-technical challenges

1.14 Conclusions

Evaluation

Based on a written seminar assignment as well as participation on a seminar day.

Curriculum vitae

Dominic O'Brien is a Professor of Engineering Science at the University of Oxford, where he is Deputy Head of Department and leads the optical wireless communications group. He gained MA(1991) and PhD (1993) Degrees from the Department of Engineering at the University of Cambridge. From 1993-1995 he was a NATO fellow at the Optoelectronic Computing Systems Center at the University of Colorado. His current research is in the field of optical wireless systems, particularly in the implementation of optical wireless systems. He is the author or co-author of approximately 150 publications or patents in the area of optics and optoelectronics.