

## Guest Editorial

### Optical wireless communications: Systems and networks

Welcome to this Special Issue in which we explore recent thinking and developments concerned with the optical wireless communication systems and networks. The demand for access to higher data rate in wireless access network, wireless multimedia applications and wireless video is growing. There are mainly two technologies, radio and optical, capable of offering these services. Radio has the advantage of being available ubiquitously both outdoor and indoor and it also offers mobility. Radio technology, although most suitable for moderate-speed applications, may not be sufficient to support high-speed applications. On the other hand, optical is primarily an indoor technology and as a medium for short-range high-speed wireless communications, it offers advantages over radio, such as: (i) unregulated wide bandwidth; (ii) low interference due to localized transmission within a room; (iii) no multipath fading; and (iv) spectral re-use within a room or building. As a result, optical wireless transmission systems have received considerable interest over the last few years. They have already been used in applications from more complex wireless LANs such as those being specified by the IEEE 802.11 and ETSI (HIPERPLAN) to simple remote controllers for home appliances.

In optical wireless communication systems the average power emitted is limited by eye safety. Therefore, power efficient modulation techniques are desirable. The paper by Ghassemlooy et al. gives a brief review of optical wireless communication and in particular modulation techniques. The paper focuses on digital pulse interval modulation and compares its performance with non-return to zero on-and-off keying (OOK) and pulse position modulation (PPM). Indoor optical wireless transmission systems suffer from multipath dispersion that results in intersymbol interference, interference produced by ambient light, co-channel interference, mainly in LAN-based systems, inherent user mobility and unavoidable changes within the surrounding environment. Simulation models are effective tools to understand the propagation characteristics of the indoor optical channel. Lomba and co-authors have developed a computationally efficient algorithm for the simulation of indoor optical channels, considering multipath reflections, which approximate the emitted and receiver patterns and the propagation environment.

Spread spectrum (SS) techniques proposed by Wong et al. is one way of combating the problems of multipath dispersion and interference due to ambient light. This paper investigates the bit error rate performance of SS and compares it with both OOK and PPM. It shows that SS technique, just like PPM, is more robust to dispersion and interference than OOK. Diversity detection antenna (DDA) structure has been suggested to reduce multipath dispersion and the received ambient light as well as to increase the received signal power and omitting shadowing. Sterckx et al. report a study carried out in order to evaluate the performance of a novel, less complex DDA structure. They have shown that the signal burnout under highly directive spotlights can be reduced effectively by employing a single receiver antenna that collects light with a field-of-view of 180°.

An optical wireless LAN-based system has been suggested in order to extend the existing optical fibre broadband integrated services digital network into wireless environments. Barker and co-worker, have investigated the performance of an Infrared Data Association link and infrared link access protocol, which is based on HDLC protocol operating in normal response mode, using the concept of frame's virtual transmission time. The model examines the time required for retransmission of packets and the probabilities of retransmission. The model can be used to determine the optimum parameter setting for a particular link and media environment.

The paper by Theodorou investigates the performance of a hybrid handover priority-based medium access control protocol to support asynchronous transfer mode (ATM) voice services over optical wireless LANS. Performance parameters such as packet dropping probability, new and handover call blocking probability, average access delay, etc., are verified theoretically. Ozugur et al. focus on the Automatic Repeat request (ARQ) protocol to provide reliable communication over the optical wireless

links. The paper addresses the retransmission techniques in the optical wireless link access protocols by investigating the performance of Go -Back-N and Selective-Reject automatic repeat request protocols in the link access control layer. The performance evaluation of a Token Passing Access Method applied to an ad-hoc wireless LAN is carried out by Freitas and co-worker. Their study reveals a correlation between the throughput and end-to-end delay versus the mesh connectivity characteristics and the wealth of knowledge of the local views.

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