



*Lasers and Electro-optics Society
Hong Kong Chapter*

Seminar

**Center for Advanced Research in Photonics
Department of Electronic Engineering
The Chinese University of Hong Kong**

Practical Applications of Optical Parametric Amplifiers in Optical Communication Systems

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**Date : 21 October 2004 (Thursday)
Time : 4:00 P.M.
Place : Room 418, Ho Sin Hang Engineering Building,
The Chinese University of Hong Kong, Shatin, N. T., Hong Kong**

Abstract

One of the most promising techniques in fiber optical communication is wavelength division multiplexing (WDM). By fully utilizing the large available low-loss (0.2 – 0.4 dB/km) transmission bandwidth (~300nm), a single fiber can potentially support tens of terabit per second of transmission over thousands of kilometers, to meet the exponentially growing capacity demand. One of the key components for deploying WDM systems is the optical amplifier. However, the conventional erbium-doped fiber amplifier (EDFA) is limited by its bandwidth (~1530 – 1610nm). Thus, alternative types of optical amplifiers are investigated, and the fiber optical parametric amplifier (OPA) is definitely one of the most promising technologies.

A fiber OPA relies on the third-order nonlinear susceptibility $\chi^{(3)}$ of glass: a signal frequency at ω_s will be amplified by a strong co-propagating pump at ω_p in a fiber through this parametric process. Therefore, OPA may find applications as optical amplifiers in WDM transmission. Another frequency, called idler, will also be generated at $\omega_i = 2\omega_p - \omega_s$. This contains essentially the same modulation information as the input signal, but with an inverted spectrum. This phase-conjugated idler can be used not only for wavelength conversion in WDM networks, but also for mid-span spectral inversion (MSSI) which can combat fiber dispersion and even some of the detrimental fiber nonlinearities such as self-phase modulation (SPM) or cross-phase modulation (XPM). In order to deploy OPA in MSSI, the idler generated must not be spectrally broadened, which is common in one-pump OPA configuration. We have demonstrated a novel technique to cancel the idler broadening by using two pumps phase-modulated 180° out of phase, one of them being obtained by four-wave mixing in an auxiliary fiber. The resulting OPA idler quality is comparable to that of the output signal.

Different aspects will be covered in this talk including high-performance OPA with wide-bandwidth and large signal gain, polarization sensitivity (both one-pump and two-pump configurations), pump efficiency, fiber optical parametric oscillator (OPO) and narrow-linewidth wavelength converter.

Biography

Dr. Kenneth Kin-Yip Wong received combined B.E. (1st class honor with medal award) degree in electrical engineering and B. S. degree in physics from the University of Queensland, Brisbane, Australia, in 1997. He received the M.S. degree in 1998 and the Ph.D. degree in 2003, both in electrical engineering at Stanford University. He was a member of the Photonics and Networking Research Laboratory at Stanford University. His research field included DWDM systems, SCM optical systems, fiber nonlinearity, and fiber optical parametric amplifiers. He is author or coauthor of over 50 journal and conference papers. He worked in Hewlett-Packard Laboratories as research engineer and contributed in projects included parallel optics and VCSEL in 1998-99. He also worked as independent consultant in Innovation CORE (A Sumitomo Electric Company), CA, in 2004.

He was the recipient of OSA New Focus Student Award in 2003 and IEEE/LEOS Graduate Student Fellowship in 2003. He is the reviewer for *Optics Letters*, *JOSA B*, *Optics Express*, *IEEE Photonics Technology Letters*, *IEEE/OSA Journal of Lightwave Technology* and *Optics Communications*. Dr. Wong is currently an Assistant Professor in the Department of Electrical and Electronic Engineering in the University of Hong Kong. He is a member of the IEEE, and IEEE Lasers and Electro-Optic Society (LEOS).

***** ALL ARE WELCOME *****

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