

Invited paper

Fiber-optic parametric amplifiers and their applications

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Abstract

A review of recent developments on fiber-optic parametric amplifiers will be given. Distinct features will be discussed and compared with other kinds of amplifiers. Different applications, including all-optical sampling, signal regeneration, all-optical switching, and add-drop multiplexing will be discussed in some detail.

Extended Abstract

A relatively new kind of amplifier is the fiber optic parametric amplifier (FOPA) which relies on the nonlinear process four-wave mixing. While the fundamental principles of FOPAs have been known for more than twenty years, it is only recently that it has become possible to implement these in a practical way. Key components in a FOPA are the high-power, single-wavelength pump laser and a specifically tailored highly nonlinear, low-dispersion optical fiber. The FOPA is unique in many ways when comparing with other amplifiers, e.g. having a gain spectrum almost entirely dictated by the dispersion properties of the fiber and the possibility of reaching a quantum limited noise figure of 0-dB. It provides uni-directional and single-polarization amplification and can have high pump-to-signal conversion efficiency as well as very high gain. It has several potential applications (besides amplification) as it reacts almost instantaneously, for example wavelength conversion, tunable filters and delays, pulse generation, signal regeneration, and all-optical ultrafast sampling. The latter has been demonstrated with equivalent-time sampled RZ data at 640 Gbit/s and with real-time sampled (Nyquist bandwidth limited) data with 50 GHz bandwidth. This was also recently expanded to phase-sensitive sampling allowing constellation diagram analysis at 40Gbaud and well beyond.



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Andrekson received his Ph.D. from Chalmers University of Technology, Sweden in 1988. After three years with AT&T Bell Laboratories he returned to Chalmers where he is a full professor. He was Director of Research at Cenix Inc. during 2000-2003 and with Center for Optical Technologies at Lehigh University, in 2003-2004. His research includes many aspects of optical communication including amplifiers, all-optical functionalities, and high-speed transmission. He is co-founder of Picosolve Inc., and authored 320 publications seventy of which were invited papers at leading conferences and journals. Andrekson is a Fellow of the Optical Society of America and of the IEEE.