

280

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Title:Enhancement of spectral resolution and optical rejection ratio of Brillouin optical spectral analysis using polarization pulling

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Abstract:High-resolution, wide-bandwidth optical spectrum analysis is essential to the measuring and monitoring of advanced optical, millimeter-wave, and terahertz communication systems, sensing applications and device characterization. One category of high-resolution spectrum analyzers reconstructs the power spectral density of a signal under test by scanning a Brillouin gain line across its spectral extent. In this work, we enhance both the resolution and the optical rejection ratio of such Brillouin-based spectrometers using a combination of two techniques. First, two Brillouin loss lines are superimposed upon a central Brillouin gain to reduce its bandwidth. Second, the vector attributes of stimulated Brillouin scattering amplification in standard, weakly birefringent fibers are used to change the signal state of polarization, and a judiciously aligned output polarizer discriminates between amplified and un-amplified spectral contents. A frequency resolution of 3 MHz, or eight orders of magnitude below the central optical frequency, is experimentally demonstrated. In addition, a weak spectral component is resolved in the presence of a strong adjacent signal, which is 30 dB stronger and detuned by only 60 MHz. The measurement method involves low-bandwidth direct detection, and does not require heterodyne beating. The measurement range of the proposed method is scalable to cover the C + L bands, depending on the tunable pump source. The accuracy of the measurements requires that the pump frequencies are well calibrated. &copy; 2012 Optical Society of America.

Number of references:35

Main heading:Polarization

Controlled terms:Bandwidth - Communication systems - Optical communication - Power spectral density - Spectrum analysis - Spectrum analyzers

Uncontrolled terms: Birefringent fibers - Brillouin - Brillouin gain - Brillouin loss - Detuned - Device characterization - Direct detection - Frequency resolutions - High resolution - High-resolution spectra - Low-bandwidth - Measurement methods - Measurement range - Optical frequency - Optical rejection ratios - Optical spectrum analysis - Orders of magnitude - Pump frequency - Pump sources - Sensing applications - Signal state - Spectral components - Spectral content - Terahertz communication systems

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