University of Central Florida

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Remove Fiber Optic Signal Distortions with Virtual Filters

Compensate for linear and non-linear distortion in fiber optic communication links using wavelet filtering in virtual backward propagation.

Transmitting a signal over long haul optical fiber links leads to undesirable distortions, which in order for the signal to be effectively received, these distortions must be compensated for and the original signal recovered. Signal distortion results from linear processes, such as absorption and fiber chromatic dispersion, and non-linear processes, such as cross-phase modulation, four-wave mixing, and amplifier noise. Previously, physical means such as specialty fibers were used to correct these signals after transmission. Now, digital methods make use of inverse Fourier-Transform calculations to compensate for both linear and non-linear distortion.

Advantages

Compared to previous electronic correction techniques using inverse Fourier-Transform methods, wavelet-based filtering offers a significant computational advantage by reducing filter length by more than four-fold. By using wavelet filters, you can now compensate for linear and non-linear impairments in an optical communication link in the electronic domain. Electronic filtering provides a simplicity that physical domain compensation systems cannot offer, while offering the capability to retrofit to existing networks.

Technical Details

To compensate for the distortion, this novel technology first generates a model of the fiber by calculating the propagation of a wave through the fiber and creates a virtual fiber. This model is then used to real-time correct the transmitted signal by propagating the distorted signal backwards through the system in an electronic virtual environment. By reversing the sources of error, this electronic approach is more versatile and adaptable than physical means, as those are limited to material and physical characteristics. This technology is extendable to multi-wavelength schemes and can even be retrofitted to existing transmission systems.

UCF Inventors

Guifang Li, Ph.D.; Gilad Goldfarb, Ph.D.

Publications

Goldfarb, G.; Guifang Li, "Wavelet split-step backward-propagation for efficient post-compensation of WDM transmission impairments," Optical Fiber Communication - includes post deadline papers, 2009. OFC 2009. Conference on, vol., no., pp.1, 3, 22-26 March 2009.

Benefits

- Removes signal distortions
- Simplifies electronic filtering
- Four-fold reduction in filter length

Applications

- Optical signal transmission
- Stock trading fiber telecom

Tech Fields

Communications, Optics & Lasers, Signal Processing

Keywords

optical communication, transmission impairment, wavelet filter, signal processing, electronic compensation

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If you or your company are interested in this opportunity, Contact:

John Miner | 407.882.1136 | John.Miner@ucf.edu | Tech ID# 31724

UCF Office of Technology Transfer | 12201 Research Parkway, Suite 501, Orlando, FL 32826