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Optical back propagation for mitigation of linear and nonlinear impairments in optical networks

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An optical back propagation (OBP) technique is investigated to compensate for nonlinear impairments in point-to-point fiber optic communication systems as well as in networks with reconfigurable optical add-drop multiplexers (ROADMs). An OBP module consisting of an optical phase conjugator (OPC), amplifiers and dispersion-decreasing fibers (DDFs) fully compensates for the dispersion and nonlinear impairments of a transmission fiber. The dispersion profile of the DDF is calculated analytically by demanding that the OBP module compensates fully the nonlinear impairments due to the transmission fiber. The OBP module can be placed after each transmission fiber (inline OBP case) or at each network node (node OBP case). Although the digital back propagation can compensate for inter-channel nonlinear impairments in point-to-point systems, it would be impossible to mitigate these effects in digital domain in fiber optic networks since the channel path information is not available to the receiver. In contrast, OBP can compensate for inter-channel nonlinear effects in optical networks. Our simulation result shows that the OBP brings a significant performance advantage as compared to digital back propagation techniques in optical networks. In our simulations, non-ideal effects of the OBP module such as dispersion fluctuations of DDF, laser phase noise and relative intensity noise (RIN) of the laser used in OPC are included. We found that the node OBP outperforms the inline OBP since the noise introduced by the OPC in the case of inline OBP leads to performance degradations.

Biography

Shiva Kumar has completed his PhD degree (1997) from Osaka University, Japan. He has worked as a Post-doctoral Fellow at University of Jena, Germany, supported by Alexander von Humboldt Foundation from 1997-98. He has worked at Corning Incorporated, NY as a Senior Research Scientist (1998-2001). Currently, he is a Professor at McMaster University, Canada. He has published about 72 papers in many journals, authored a book on Fiber Optics, 7 book chapters, edited a book on Non-linear Fiber Optics, and holds 8 US patents.

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