Signal-to-Noise Ratio Control in Optical long-haul Networks using Dynamic Gain Filters

This work presents optimality results and fast control algorithms for dynamic gain equalizers (DGE) with respect to optical signal-to-noise ratio (OSNR) control. As development of optical wavelength division multiplexed (WDM) networks is moving from static managed point-to-point connections toward dynamic mesh networks, decentralized on-line algorithms are required to replace static adjustment procedures. In long-haul links several erbium-doped fibre amplifiers (EDFA) jointly amplify all WDM channels, thus interconnecting signal power levels and OSNR of all channels sharing a link. This effect is captured in a recent model by Pavel (2005). We extend this model with a weight profile and show that the optimal input power vector is the Perron eigenvector of an interconnection matrix. Then result is extended from a local control span of one DGE to a link with several concatenated DGE spans. A decentralized control scheme with independent local control algorithms is developed that is inherently robust and convergence is geometrical. Moreover, the introduced weights are used for a hierarchical adjustment scheme enabling a network-wide decentralized channel-wise control of OSNR. Numerical simulations show that convergence of the algorithms is fast and robust with respect to constraints.

Pavel, L. (2005), A nested Noncooperative OSNR Game in Optical Links with Dynamic Gain Filters, in 'Conference on Decision and Control'.

The talk will be in English.