Optimization of Optical Communication Systems by Means of Genetic Algorithms

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Abstract: The stochastic method of genetic algorithms has already been successully applied to solve inverse problems occuring in monochannel optical communications filters. We show here that it is also an efficient solution for multichannel filter applications. In particular, it enabled us to find a specific Fiber Bragg Grating (FBG) design allowing the realization of a multichannel filter consisting of 16 identical and perfect transmission channels spaced of 100 GHz.

As commonly used in shape optimization problems, a spline interpolation technique has been introduced in order to generate a general FBG design with a reduced number of parameters. The latter have then been optimized with a genetic algorithm process based on the three usual evolution principles of selection, crossover and mutation.

For a 100 mm long multichannel filter centered aound 1550 nm, this technique has lead to better results than other classical methods all based on a Fourier transform approximation. Apart from the improved quality of its reflectivity spectrum, the new solution exhibits also a smaller value of maximum index modulation and a reduced number of phase shifts (properties linked with the chosen research field), thus allowing an easier industrial realization process.

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