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Measurement of phases and amplitudes of AWG by fitting interference intensities

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Abstract We measured the phases and amplitudes of an arrayed waveguide grating (AWG) by fitting interference intensities via a frequency domain method. The intensities were recorded as a function of the laser frequency in an interferometer containing the AWG. We fit the theoretical intensity profile to the recorded data via the Monte-Carlo method after filtering out the low-frequency noise. The phases and amplitudes are the parameters in the fitting process, and hence, the values are determined from the final fit. The variations in the measured phase values with the change in the initial condition of the Monte-Carlo process were less than 0.1°. The variations in the measured amplitude values were negligible. In order to verify our measurement, we calculated the transmission spectrum of the AWG using the measured phases and amplitudes and compared it with a directly measured spectrum. The calculated and measured spectrums are in good agreement with each other.

Keywords Arrayed waveguide grating (AWG) · Phase measurement · Interferometer · Monte-Carlo method · Intensity fitting

1 Introduction

Low-crosstalk arrayed waveguide gratings (AWGs) are key components in dense wavelength-division-multiplexing (DWDM) photonic networks (Doerr and Okamoto 2006). The crosstalk depends on the phase errors of the waveguide array and can be reduced via various compensation techniques (Sim et al. 2007; Takada et al. 2001, 2005). The compensation should be preceded by a precise measurement of the phase distribution.

The phases of AWGs can be measured by the optical low coherence method (Takada et al. 1996; Lazaro et al. 2003; Chen et al. 2003) or frequency domain method (Takada and Okamoto 2000; Takada and Satoh 2006; Takada and Hirose 2009). In optical low coherence

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