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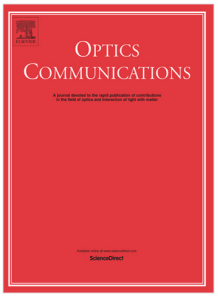

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Modes Coded Modulation of Vector Light Beams Using Spatial Phase Cross-polarized Modulation

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Abstract

Vector light beams (VLBs), manifesting as the non-uniform spatial distribution of polarization states, have shown broad applications in increasing communication capacity. Here, we propose and experimentally demonstrate a spatial phase cross-polarized method for achieving a mode coded modulation of VLBs. By employing the polarization sensitivity of the spatial light modulators (SLMs), the left and the right-handed circularly polarized parts of light beams are modulated with opposite spatial spiral phase to produce VLBs by the coherent combination. Manipulating the spatial phase distribution of the left and the right-handed circularly polarized light beams, the VLBs with 16 modes ([m; l]=[2, 3, 4, 5, 3, 4, 5, 6, 4, 5, 6, 7, 5, 6, 7, 8; 0, -1, -2, -3, 1, 0, -1, -2, 2, 1, 0, -1, 3, 2, 1, 0]) are obtained and used to code digital signals. In the experiment, a 60 × 60 pixels flower gray image with 14400 quaternary numbers are then coded to the 16 modes and decoded successfully after 1 *m* transmission in free space. And the flower gray image is also recovered accordingly.

Keywords: Mode coded modulation; Vector light beams; Optical communications.

1. Introduction

The polarization state of light beams, one of the most fundamental physical quantity in classical and quantum mechanics, has a pivotal role in increasing communication capacity by polarization-division-multiplexing (PDM) and polarization-coded-modulation (PCM) [1, 2]. Usually, only two orthogonal linear states of polarization (SOP) are employed for PDM, seriously hindering the further increasing of communication capacity. The PCM also seems to be impractical because of lacking available orthogonal polarization states, making the further development of polarization-based communication hampered. Recently, vector light beams (VLBs), showing spatially variant