19p-A14-3

空間変調器による 5 ビームコヒーレント結合

Coherent combination of five beams using a spatial modulator

レーザー総研 [1]，三菱重工 [2]　○ハイク コスロービアン [1]，染川智弘 [1]，藤田雅之 [1]，
井澤靖和 [1]，石井伸也 [2]

ILT [1], MHI [2] ○H. Chosrowjan[1], T. Somekawa[1], M. Fujita[1], Y. Izawa[1] and S. Ishii[2]

E-mail: haik@ilt.or.jp

Introduction

To obtain high intensities from multi-kilowatt class laser systems, beam combining concept seems to be one of the viable choices. In some specific applications like in coherent LIDAR, employing just a single photo-detector (PD) for all channels is desirable. Several CBC techniques for multiple laser beams using a single PD have been already proposed and implemented (multi-dithering technique, stochastic parallel gradient descent algorithm based technique, etc.). Most of these techniques require sophisticated electronics and phase retrieval/control algorithms. In this contribution we will present and discuss a new method where a single PD is employed for active phase control and locking of multiple laser beams using a spatial modulator and simple phase control algorithm. As a proof of a principle, it is demonstrated for three and five beam CBC cases.

Experimental results and discussion

The laser beam (d ~ 2 mm) is split into five equal channels with ~ 4 mm distance between them. All five beams imitate “amplified” beams to be combined coherently (Fig. 1).

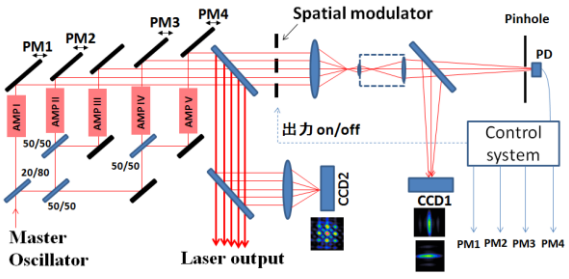

Fig. 1 Exp. setup for single detector CBC for five beams

To compensate and lock the phases of five beams, a signal from the center of the far-field pattern was picked up by a fast photodiode and used it as a feedback control signal to piezo-actuators (PM1 – PM4) located on the paths of four beams. We introduced a spatial modulator between the beam splitter and collimating optics in the path to the single PD (Fig. 1). The idea is simple: dividing the *N* number of beams (the central beam is used as a reference beam and is not numbered) into clusters and doing CBC in sequence, with as small number of beams as possible. A simple “climbing hill” algorithm for a single cluster (three beams) is employed in sequence to maximize the far-field signal intensity. Fig. 2 shows main results of CBC for five beams.

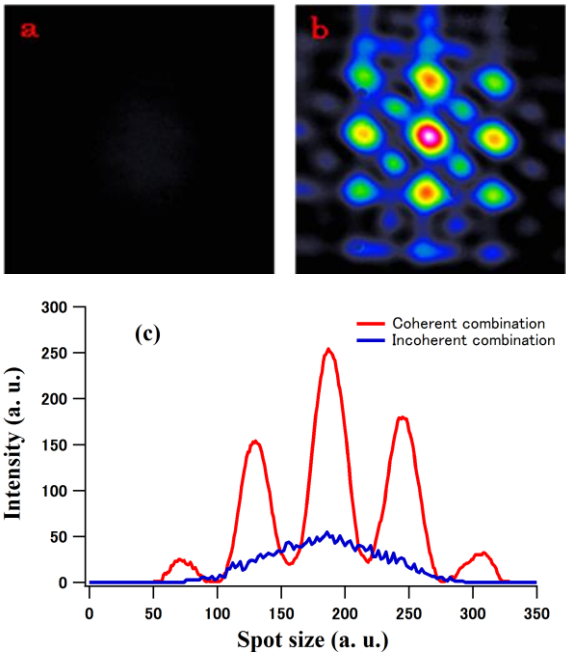

Fig. 2 CCD images of a single beam **(a)**, coherently combined five beams **(b)**, intensity distributions on a (x, 0) axis for coherent and incoherent combinations **(c)**

In conclusion, the proposed CBC technique is not limited by single beam power and can be used in various MOPA architectures.