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Generation of Mathieu-Gauss beams with an intra-cavity spatial light modulator

Helmholtz–Gauss beams (HGBs), nearly non-diffraction beams that can propagate a long distance without significant divergence, have attracted considerable attention for their potential applications in science and technology. Mathieu-Gauss beams (MGBs) are one kind of Helmholtz–Gauss beams, which are the ideal non-diffraction Mathieu beams apodized by Gaussian transmittance. Unlike the ideal non-diffracting Mathieu beams, MGBs can be realized experimentally for the reason that MGBs carry a reasonable finite power. The nearly non-diffraction properties of MGM show their potential to lots of practical applications, such as: optical interconnections, laser machining, collimation and measurement, optical manipulation, etc. Alvarez-Elizondo et al. first generated MGBs in an axicon-based stable resonator in a real CO2 laser by slightly breaking the symmetry of the cavity in 2008. Later, Tokunaga et al., adopted special micro-grain Nd:YAG laser crystals, they also achieved spontaneous MGMs oscillation in end-pumped solid-state lasers. A general approach for the selectively excitation of any specified MGM in a laser system is necessary for the development of future MGBs' applications. This study investigated in finding a way to selectively excite any specified MGM in an end-pumped solid-state laser system with an intra-cavity spatial light modulator. We drafted codes to simulate the lasing operation of the laser system to explore the selectively exciting a specified MGM in end-pumped solid-state lasers using numerical simulation. This study proposed a systematic approach to the selective excitations of all Mathieu-Gauss modes (MGMs) in end-pumped solid-state lasers with a SLM-based stable laser resonator.

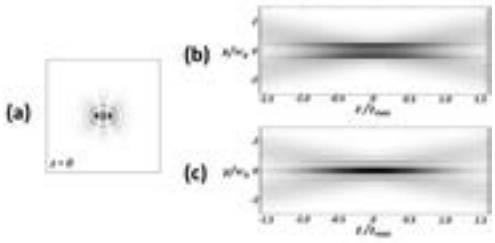

Figure1: It shows propagation of amplitude profile along plane (x, z) or plane (y, z) of an even MGB from the simulated laser resonator with mode order m=2 and ellipticity parameter q=5.

Biography

Shu-Chun Chu received her PhD degree from the Institute of Electro-Optical Engineering, National Chiao Tung Univisity. She currently serves as a Professor in Department of Physics, National Cheng Kung University. She has her expertise in designing laser cavity and finding approaches for generating various structure beams in solid-state lasers. She also has expertise in designing non-imaging optical systems, such as solar concentrators, LED illuminators, backlight modules, etc.

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