NUMERICAL OPTIMIZATION IN SOLID STATE LASER PUMP CAVITY DESIGN

MASOUMEH GHAFFARI-HADIGHEH∗
ALIREZA GHAFFARI-HADIGHEH†

Designing laser pump cavity is one of the challenging issues in physics. Homogenously pumping of lasing media (rod) has main effects in compensation of strains and stresses. One might make use of several elements such as fixed mirrors with different curvatures to overcome this problem. It seems that placing complex system of parabolic mirrors is a suitable tool. Places of these mirrors together with their cavity can vary and henceforth change the efficiency of the system.

To find better design of the mirrors (focal lengths and their distance from center of rod as unknowns) one can use optimization methods. Heuristics such as genetic algorithm has been used for this propose. These method might lead to a better design but not optimal.

Here, we formulate the problem as a nonlinear constrained optimization model for a system with four front parabolic mirrors together with a rear mirror with a fixed focal length. The focal lengths of the front mirrors and their places are unknown. Moreover the distance of light guide from the center of rod and its place are unknown too. In this way, there are ten unknowns. The objective function of the problem is minimizing the distance of the reflected light from the center of the rear mirror, while keeping it close to the center of the rod. Solving this problem with numerical methods such as line search leads to a local minima.

Keywords: Laser Design, Solid State Laser, Nonlinear Optimization, Numerical Optimization.

∗ Dept. of Physics, Tabriz University, Tabriz, Iran
† Dept. of Mathematics, Azarbaijan University of Tarbiat Moallem, Tabriz, Iran
E-mail address: ∗masoumeh.ghaffari@gmail.com
E-mail address: †hadigheha@azaruniv.edu