Analytical Model of Transient Thermal Effects in Microchip Laser Crystal

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Abstract. Transient thermal model of temperature and stress field in solid-state microchip laser crystal was obtained analytically using integral transform method. The effect of changing the face convection heat transfer coefficents were studied. Results revolve that at a pump power of 3 W, the maximum temperature rise is 27.78 C located on the center of the pump face. By calculating the additional optical path length, the thermal focal length of 1.2124 m was obtained under the Gaussian pump distribution. The effect of increasing the face and the edge heat transfer cooling coefficients with different pump power were also studied and it was found that increasing cooling coefficients can lead to decrease time to reach steady state and can reduce temperatures and stresses distribution in laser rod. Good agreement was obtained by comparing the result of this work with other earlier works in literature.