# Abstract

Thin-disk diode-end-pumped solid-state laser attracts more and more attention due to its high efficiency, high available peak power, high beam quality, and simple, efficient cooling system. The demand for high laser power needs an efficient cooling system to dissipate the heat ,that could be generated through the laser generation , to avoid its detrimental effects such as medium fracture and deformation of the laser beam. So, studying temperature distribution, stress, and strain induced due to heat generation inside the thin disk is the critical factor in studying their effect on the laser medium that contains the generated heat. In this thesis, the integral transform method to derive the analytical solution of thermal effects in thin-disk laser is worked. Good agreements were found between the result of this work and other solutions for the same problem. The temperature distribution and its effect on laser crystal were obtained. It was found that increasing cooling of the thin disk leads to a decrease in temperature difference across the crystal, which decreases the generated stress and strain and subsequently enhance beam quality (i.e, reduce optical path difference); also, it was found that as cooling is increased the allowable pumping power (before fracture could occur) is increased too. It was found that reduce disk; thickness has the same effect of increasing cooling of the disk this is because as thickness decreases, the heat could dissipate more efficiently.