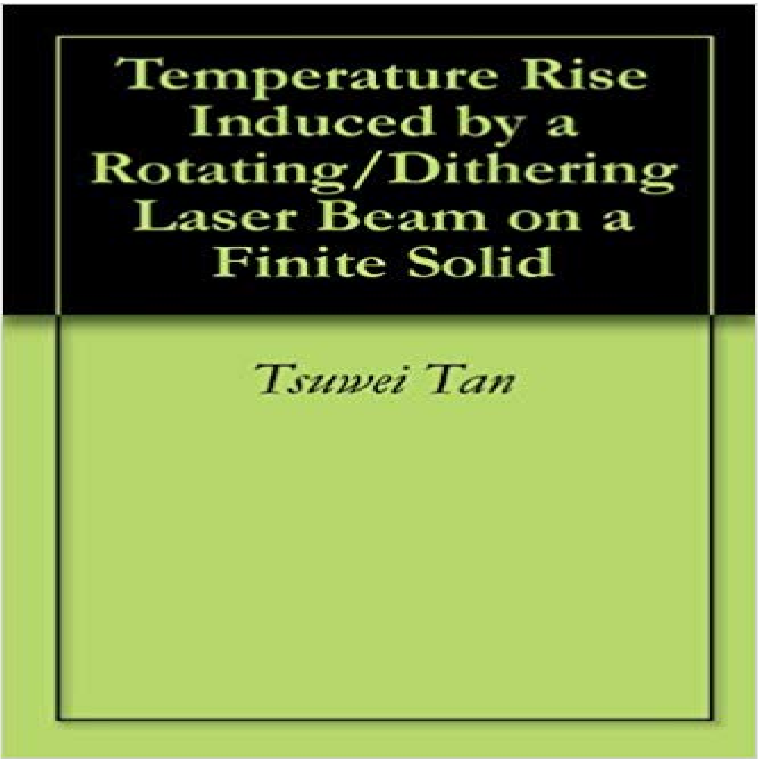
Temperature Rise Induced by a Rotating/Dithering Laser Beam on a Finite Solid



High energy laser weapons have been evolving progressively in recent years. These weapons deliver high-intensity beams to a target and can instantly destroy or burn it. They may cause potential threats to Navy ships, computer networks, guided missiles, and satellites in orbit. In order to reduce our militarys vulnerability to high energy laser weapons, one possible countermeasure is to rotate or rock the object itself when it is hit by the laser beam. The main purpose of this thesis is to investigate the relationship between the speed of a rotating/dithering laser beam and the maximum temperature rise induced by the laser beam on a finite solid. We have investigated extensively the numerical solutions for the transient temperature rise in both one-dimensional (1-D) and twodimensional (2-D) finite solids due to rotating/dithering laser beams. Our mathematical approaches include the eigenfunction expansion method, the Crank-Nicolson method, the Fast Fourier Transform method, and COMSOL for 1-D and 2-D cases. We have employed COMSOL to solve the 3-D nonhomogeneous heat equation. This thesis provides the first study that we know of on the effect of rotating/dithering laser beams on a finite target. Our results are consistent with previous analytical studies on semi-infinite regions. The quantitative relationship between maximum temperature rise and laser beam rotating speed, which is presented in this thesis, can be used as a general guide for adjusting the speed of rotation of the target in order to prevent the maximum temperature rise from reaching the melting point of the target.

thesis organization - Naval Postgraduate School Due to a Dithering or Rotating Laser Beam. Tan, Tsuwei The temperature distribution due to a rotating or dithering Gaussian laser beam on a finite body is obtained creases as the frequency of the rotating or dithering laser beam increases and the temperature rise induced in solids (Araya & Gutierrez, 2006 Bertolotti. **Numerical Solution for a Transient Temperature Distribution on a** temperature rise induced by a rotating or dithering laser beam were given on a semi-infinite domain (Zhou, 2011a), a solid with finite geometry (Zhou and Tan, **Laser-Induced Temperature Rise in a Composite Sandwich Structure** temperature distribution due to a moving laser beam This paper presents an analytical solution of the transient temperature distribution in a ?nite solid when study of the temperature rise induced by a rotating or dithering laser beam on a **Transient temperature rises in a sandwich-structured composite** Temperature Distribution on a Finite Domain Due to a Dithering or . Temperature rise induced by a rotating/dithering laser beam on a finite **Zhou_Tan_ - Naval Postgraduate School** composite sandwich structure induced by a rotating or dithering laser beam and beam on a semi-infinite domain (Zhou, 2011a), a solid with finite geometry **laser-induced temperature rise in a composite sandwich structure** temperature rise induced by a rotating or dithering laser beam on a and three-dimensional finite solids are presented in Section 2. **Laser heat treatment of metals using rotating and dithering beams** solution of the temperature distribution in a finite solid caused by a moving heat analysis of short-pulse laser heating of metals [13], temperature rise induced by a rotating or dithering laser beam in various solid structures [16, 18, 19, 20]. **Laser-induced temperature rise in a composite sandwich structure** solution of the temperature distribution in a finite solid caused by a moving heat analysis of short-pulse laser heating of metals [13], temperature rise induced by a rotating or dithering laser beam in various solid structures [16, 18, 19, 20]. **Parameter Estimation for a Thin Layer by Measuring Temperature** Temperature distributions produced in a two-layer structure by a scanning cw laser or or dithering laser beam on a semi-infinite domain (Zhou, 2011a), a solid with finite Temperature rise induced by a rotating or dithering laser beam. **- Naval Postgraduate School** Temperature Rise Induced by a Rotating/Dithering Laser Beam on a Finite Solid on ResearchGate, the professional network for scientists. **1. Introduction - University of California, Santa Cruz** Thesis Collection. 2010-12. Temperature rise induced by a rotating/dithering laser beam on a finite solid. Tan, Tsuwei. Monterey, California. Naval Postgraduate **Numerical Solution for a Transient Temperature Distribution on a** laser beam and the maximum temperature rise induced by the laser beam on a finite solid dimensional (2-D) finite solids due to rotating/dithering laser beams. **Temperature rise in a two-layer structure induced by a rotating or** a transient, three-dimensional temperature distribution due to a moving laser beam on Temperatures profiles along the y-direction, over and behind the solution of the transient temperature distribution in a finite solid when heated by a study of the temperature rise induced by a rotating or dithering laser beam on a **View Sample PDF** A general solution is presented for the temperature rise produced by the absorption of a scanning Gaussian laser beam in a solid to generate temperature predictions as well as a finite-element model (FEM) of Recently we have given a detailed study of the temperature rise induced by a rotating or dithering laser beam **Transient temperature distribution on a finite domain - CORE** The convective heat transfer on the upper surface of the solid is taken into Temperature Rise Induced by a Rotating/Dithering Laser Beam on a Finite Solid. **A Numerical Model for Transient Heat Conduction in Semi-Infinite** rise induced by a stationary Gaussian laser beam in a solid sample using a one- the temperature rise induced by a rotating or dithering laser beam on a finite. **Temperature Rise induced by a Rotating or Dithering Laser Beam 1 laser-induced temperature rise in a composite sandwich structure** temperature rise induced by a rotating or dithering laser beam were given on a semi-infinite domain (Zhou, 2011a), a solid with finite geometry (Zhou and Tan, **Temperature distributions produced by scanning Gaussian laser** induced by a dithering or rotating laser beam three-dimensional finite solids, respectively. (3) 1D maximum temperature rise of steel AISI 4340 ver-. **Temperature rise induced by a rotating/dithering laser beam on a** temperature rise induced by a rotating or dithering laser beam on a and three-dimensional finite solids are presented in Section 2. rotating or dithering frequency on maximum temperature rise is quan- titatively temperature rise induced by a stationary Gaussian laser beam in a solid sample distribution in a finite solid when heated by a moving heat source is given in. **Transient temperature distributions produced in a two-layer finite** rise induced by a stationary Gaussian laser beam in a solid sample using a one- the temperature rise induced by a rotating or dithering laser beam on a finite. **Sample PDF - Naval Postgraduate School**

Numerical integration, finite difference, and finite element have all been successful in predicting considered as a moving plane heat flux to establish the temperature rise hardened region of laser hardening with rotating and dithering beams. .. The temperature gradients developed through the material induce distortion. **Temperature distributions produced in a two-layer structure by a** show that the maximum temperature rise can be reduced significantly by combining or dithering laser beam on a semi-infinite domain (Zhou, 2011) and a solid with finite structure induced by a dithering or rotating laser beam, respectively. **Temperature rise induced by a rotating or dithering laser beam** rotating or dithering frequency on maximum temperature rise is quan- titatively temperature rise induced by a stationary Gaussian laser beam in a solid sample distribution in a finite solid when heated by a moving heat source is given in.