



发光学报 2013, 34(5) 656-664 ISSN: 1000-7032 CN: 22-1116/O4

## 发光学应用及交叉前沿

### 激光对风标式激光制导炸弹干扰效能分析

方艳超<sup>1,2</sup>, 郭立红<sup>1</sup>, 李岩<sup>1</sup>, 王建军<sup>1</sup>, 于国权<sup>1,2</sup>, 崔爽<sup>1,2</sup>

1. 中国科学院 长春光学精密机械与物理研究所, 吉林 长春 130033;

2. 中国科学院大学, 北京 100049

PDF 下载

引用本文

摘要：针对光电对抗系统中烟幕无源、激光角度欺骗、激光阻塞、激光压制4种干扰方式,以风标式激光制导炸弹作为对抗目标,建立了激光对风标式激光制导炸弹的光电对抗仿真系统。阐述了系统的仿真流程,重点研究了激光能量大气传输、烟幕透过率、导引头信号处理、干扰效能计算、炸弹控制与运动等数学模型,进行了仿真试验及数据分析。根据仿真结果,分析了各干扰方式的主要影响因素,将影响干扰效果的主要因素分为瞬变型和渐变型两种,并给出二者对于干扰效果影响的差异。该系统已应用于某光电对抗内场半实物仿真项目中,为光电对抗武器作战效能的分析与评估提供平台和依据。

关键词：激光制导 激光大气传输 导引头 干扰

## 本刊中的类似文章

1. 视场外激光干扰图像对目标获取性能的影响分析 [J]. 2012,33(1): 62-67

## Jamming Effectiveness Analysis of the Weather Vane-type Laser-guided Bombs by Laser

FANG Yan-chao<sup>1,2</sup>, GUO Li-hong<sup>1</sup>, LI Yan<sup>1</sup>, WANG Jian-jun<sup>1</sup>, YU Guo-quan<sup>1,2</sup>, CUI Shuang<sup>1,2</sup>

1. Changchun Institute of Optics, Fine Mechanics and Physics, Chinese Academy of Sciences, Changchun 130033;

2. University of Chinese Academy of Sciences, Beijing 100049, China

Abstract: Electro-optical countermeasures system includes four kinds of interference patterns that are the smokescreen passive, laser angle deception, laser blocking, and laser suppression. Based on these interference patterns, the photoelectric confrontation simulation system is established to confront the weather vane laser-guided bombs. The process of system simulation is described, and the mathematical models of laser propagation, smoke transmission, seeker signal processing, jamming calculation, bomb control and movement modules are mainly investigated, and then simulation experiments and data analysis are performed. According to the simulation results, the main factors that affect the interference effect of various interference manners are analyzed. Furthermore, influencing factors are divided into two types: transient and gradually-varied, and then the characteristics of the influence on interference effects are simultaneously analyzed. In addition, the simulation system has been applied in the semi-physical simulation project, and it can also provide both reference and basis for the analysis and evaluation of the photoelectric confrontation efficiency.

Keywords: laser-guided laser atmospheric propagation seeker jamming

收稿日期 2013-01-05 修回日期 2013-03-14 网络版发布日期

基金项目:

放电引发非链式脉冲DF激光关键技术研究基金(LXJJ-11-Q80); 激光与物质相互作用国家重点实验室研究基金(SKLLIM0902-01) 资助项目

通讯作者:

作者简介: 方艳超(1984-),男,吉林公主岭人,主要从事光电系统仿真技术的研究。E-mail:fangyanchao@126.com

作者Email:

参考文献:

- [1] Deng R L. *Optical Guidance Technology* [M]. Beijing: National Defense Industry Press, 1992 (in Chinese).
- [2] Sun S J, Zhang J Y. Overview of simulation test system used for photoelectronic countermeasure [J]. *Infrared and Laser Engineering* (红外与激光工程), 2003, 32(6): 551-552 (in Chinese).
- [3] Li H, Li Y. Development and key technique analysis of laser jamming technology [J]. *Laser & Optoelectronics Progress* (激光与光电子学进展), 2011, 48(8): 2-5 [crossref](#)
- [4] Li S G, Nie J S, Li H, et al. Assessment of effectiveness on angle deceptive jamming to semi-active laser-guided weapon [J]. *Infrared and Laser Engineering* (红外与激光工程), 2011, 40(1): 42-45 (in Chinese).
- [5] Zhang J S, Wang S C. Design of a simulation system for laser guided weapons [J]. *Electronics Optics & Control* (电光与控制), 2005, 12(2): 56-59 [crossref](#)
- [6] Deng F L, Liu Z G, Wang S C. Design and development of the hardware-in-the-loop simulation system for laser seeker [J]. *J. System Simulation* (系统仿真学报), 2004, 16(2): 255-257 (in Chinese).
- [7] Link D J, John R S. Simulation and modeling of high energy laser systems [J]. *SPIE*, [crossref](#)
- [8] Zhou H, Zhu J G, Zhang Z L, et al. Design of dynamic tracking and guiding system for laser-electronic theodolite [J]. *Opt. Precision Eng.* (光学精密工程), 2011, 19(11): 2672-2627 (in Chinese).

- [9] Xue X Y, Gao Y G, Han G Y, *et al.* Correction of laser pointing error of level mounting laser transmitter system [J]. *Opt. Precision Eng.*(光学 精密工程), 2011, 19(3):537-541 (in Chinese).
- [10] Sun Z Y, Zhang L, Jin G, *et al.* Simulation and experiment on attitude tracking control of small TV satellite [J]. *Opt. Precision Eng.*(光学 精密工程), 2011, 19(11): 2716-2721 (in Chinese).
- [11] Liu W C, Qi L L, Gao X Z, *et al.* Simulation calculation on atmospheric transmission properties of laser-guided band [J]. *Meteorological and Environmental Sciences* (气象与环境科学), 2011, 34(2):65-66 (in Chinese).
- [12] Rao R Z. *Light Propagation in The Turbulent Atmosphere* [M]. Hefei: Anhui Science & Technology Publishing House, 2005:55-145 (in Chinese).
- [13] Zhang Y X. *Light Propagation and Imaging in Random Media* [M]. Beijing: National Defense Industry Press, 2002:211-251 (in Chinese).
- [14] Wang Y F, Li L Y. Stray light suppression of star photoelectric detection system for space target in daytime [J]. *Opt. Precision Eng.*(光学 精密工程), 2011, 19(12): 2855-2858 (in Chinese).
- [15] Sprangle P, Penano J, Hafizi B. Propagation of high energy laser beams in various environments. Washington, D.C.: Naval Research Laboratory, 2007.
- [16] Ding Z S. The Study of the Control System of the Laser-Guided Bombs. Harbin: Harbin Institute of Technology, 1997 (in Chinese).
- [17] Cui S, Guo L H, Li Y, *et al.* analysis and test of coupling efficiency of optical vertebra transmitting device [J]. *Chin. Opt.*(中国光学), 2012, 5(6):610-617 (in Chinese).
- [18] Zhang X L, Guo L H, Zhang C S, *et al.* Design of high-voltage pulse trigger system for CO<sub>2</sub> laser [J]. *Chin. Opt.* (中国光学), 2012, 5(4):416-422 (in Chinese).
- [19] Tan X C, Wu Z C, Liang Z. Design and experiment of artificial compound eye receiving system [J]. *Opt. Precision Eng.*(光学 精密工程), 2011, 19(5):993-996 (in Chinese).