

天空偏振模式对仿生偏振光定向的影响及实验

范晨, 胡小平, 何晓峰, 练军想, 王玉杰

国防科技大学 机电工程与自动化学院, 湖南 长沙 410073

Influence of skylight polarization pattern on bionic polarized orientation and corresponding experiments

FAN Chen, HU Xiao-ping, HE Xiao-feng, LIAN Jun-xiang, WANG Yu-jie

College of Mechatronic Engineering and Automation, National University of Defense Technology, Changsha 410073, China

[摘要](#)[图/表](#)[参考文献](#)[相关文章 \(1\)](#)全文: [PDF](#) (1737 KB) [RICH HTML](#) ^{NEW}输出: [BibTeX](#) | [EndNote](#) (RIS)

摘要 针对工程应用中仿生偏振光罗盘易受天气和太阳位置等因素的影响,存在定向精度低、稳定性差等问题,研究了天空偏振模式对偏振光定向的影响机理。建立了含有偏振模型误差的偏振光定向模型,推导了仿生偏振光罗盘的航向角解算方法;然后系统分析了模型误差对偏振光定向精度的影响机理,指出了载体水平角和太阳高度角是决定模型误差影响程度的主要因素;最后设计了静态实验与跑车测试,评估了不同水平角和太阳高度角时,模型误差对偏振光定向精度的影响。结果表明:当太阳高度角 $h_s < 40^\circ$ 时,偏振光定向误差为 0.729° 当 $40^\circ < h_s < 75^\circ$ 时,误差为 3.764° 精度明显降低。另外,载体水平角越大,模型误差角对定向精度的影响程度也越显著;载体水平时,定向误差为 0.323° ,而倾斜后误差增大为 1.352° 。文中对仿生偏振光定向的影响机理分析为补偿偏振模型误差,实现高精度偏振光定向提供了理论依据。

关键词 : 偏振光导航, 天空偏振模型, 偏振光定向, 定向算法, 航向角误差

Abstract : To solve the problems of directional precision errors and low stability existed in a bionic polarized light compass caused by the weather and sun position or other factors, the effect mechanism of sky polarization mode on polarized orientation was researched. A polarized orientation model including model errors was built and the algorithm to calculate a heading angle for the bionic polarized compass was deduced. Then, the influence of the model errors on the polarized orientation precision was analyzed systematically. It points out that the horizontal angle and the solar altitude angle are main factors to determine the impact of the model errors. Finally, a static experiment and a dynamic car test were designed. The influence of polarized model errors on the polarized orientation precision was assessed in different horizontal angles and solar altitude angles. The results indicate that when the solar altitude angle is less than 40° , the error of polarized orientation is 0.729° . When the angle is between 40° and 75° , the precision is evidently decreased, and the error is 3.764° . Moreover, the impact of polarized model is also evidently increased as the horizontal angle. When the vehicle runs in a level, the error is 0.323° . After inclining, the error is increased to 1.352° . The error mechanism proposed provides theoretical references for compensating model errors and improving the precision of polarized orientation.

Key words : polarized light navigation skylight polarization pattern polarized orientation orientation algorithm heading angle error

收稿日期: 2015-04-02

中图分类号: V249.32

O436.3

基金资助: 国家自然科学基金资助项目(No.61104201); 国防科技大学科研计划资助项目(No.JC14-03-04)

作者简介: 范晨(1988-),男,陕西渭南人,博士研究生,主要从事仿生偏振光导航、微惯性导航及视觉导航等方面的研究。E-mail: fanchen_nudt@yeah.net

引用本文:

范晨, 胡小平, 何晓峰, 练军想, 王玉杰. 天空偏振模式对仿生偏振光定向的影响及实验[J]. 光学精密工程, 2015, 23(9): 2429-2437. FAN Chen, HU Xiao-ping, HE Xiao-feng, LIAN Jun-xiang, WANG Yu-jie. Influence of skylight polarization pattern on bionic polarized orientation and corresponding experiments. Editorial Office of Optics and Precision Engineering, 2015, 23(9): 2429-2437.

链接本文:

<http://www.eope.net/CN/10.3788/OPE.20152309.2429> 或 <http://www.eope.net/CN/Y2015/V23/I9/2429>

服务

- ▶ [把本文推荐给朋友](#)
- ▶ [加入我的书架](#)
- ▶ [加入引用管理器](#)
- ▶ [E-mail Alert](#)
- ▶ [RSS](#)

作者相关文章

- ▶ [范晨](#)
- ▶ [胡小平](#)
- ▶ [何晓峰](#)
- ▶ [练军想](#)
- ▶ [王玉杰](#)

访问总数: 6353378

版权所有 © 2012 《光学精密工程》编辑部

地址: 长春市东南湖大路3888号 邮编: 130033 E-mail: gxjmgc@sina.com

本系统由北京玛格泰克科技发展有限公司设计开发

