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论文

Gyrator变换全息图及其在图像加密中的应用

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摘要:

提出了gyrator变换全息图,利用gyrator变换快速算法模拟实现了gyrator变换全息图的产生和再现,并研究了基于相移数字全息的gyrator变换全息图.在此基础上提出了采用正弦相位光栅实现光学图像加密的新方法.该方法利用gyrator变换在相空间的旋转特性,将gyrator变换的角度、光栅的频率及光栅的旋转角度作为加密密钥,并利用两个或两个以上的gyrator变换系统的级联实现图像加密,增加了系统的安全性.依据相移数字全息进行的两个gyrator变换系统级联的仿真实验验证了该方法的可行性、有效性及其良好的安全性能.

关键词: gyrator变换 gyrator变换全息图 gyrator变换快速算法 相移数字全息 图像加密

Gyrator Transform Hologram and Its Application in Image Encryption

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Abstract:

The gyrator transform hologram is proposed. The generation and the reconstruction of the gyrator transform hologram are simulated by using the fast algorithm for computing the gyrator transform. This new type hologram based on phase-shifting digital hologram is also studied. A novel method is proposed for optical image encryption by using sinusoidal phase gratings based on the methods mentioned above. In this proposal method, the angle of gyrator transform, the frequency and the rotation angle of the gratings are regarded as the encryption keys according to the rotation properties of the gyrator transform in the phase space. Two or more cascaded gyrator transform systems are applied to realize the image encryption. The simulation experiments are performed with two cascaded gyrator transform systems on the basis of the phase-shifting digital hologram. The results confirm the feasibility, validity and the secure performance of the proposal method.

Keywords: Gyrator transform Gyrator transform hologram Fast algorithm of gyrator transform Phase-shifting digital hologram Image encryption

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参考文献:

[1] RODRIGO J A, ALIEVA T, CALVO M L. Gyrator transform: properties and applications [J]. Optics Express, 2007, 15(5): 2190-2203.

[2] RODRIGO J A, ALIEVA T, CALVO M L. Experimental implementation of the gyrator transform

[J]. Journal of Optics Society of America A, 2007, 24(10): 3135-3139.

[3] RODRIGO J A, ALIEVA T, CALVO M L. Applications of gyrator transform for image processing
[J]. Optics Communication, 2007, 278(2): 279-284.

[4] LI Hui-juan,WANG Yu-rong. Information security system based on iterative multiple-phase retrieval in gyrator domain
[J]. Optics and Laser Technology, 2008, 40(7): 962-966.

[5] LI Hui-juan, WANG Yu-rong. Double-image encryption based on iterative gyrator transform
[J]. Optics Communications, 2008, 281(23): 5745-5749.

[6] LI Hui-juan. Image encryption based on gyrator transform and two-step phase-shifting interferometry
[J].Optics and Lasers in Engineering, 2009, 47(1): 45-50.

[7] LIU Zheng-jun, GUO Qing, XU Lie, et al. Double image encryption by using iterativerandom binary encoding in gyrator domains
[J]. Optics Express, 2010, 18(11): 12033-12043.

[8] LIU Zheng-jun, XU Lie, LIN Chuang, et al. Image ncryption scheme by using iterative random phase encoding in gyrator transform domains
[J]. Optics and Lasers in Engineering, 2011, 45(5): 542-546.

[9] SINGH N, SINHA A. Gyrator transform based optical image encryption using chaos
[J]. Optics and Lasers in Engineering, 2009, 47(5): 539-546.

[10] ABUTURAB M R. Securing color information using Arnold transform in gyrator transform domain
[J]. Optics and Lasers in Engineering, 2012, 50(5): 772-779.

[11] ABUTURAB M R. Securing color image using discrete cosine transform in gyrator transform domain structured-phase encoding
[J]. Optics and Lasers in Engineering, 2012, 50(10): 1383-1390.

[12] ZHANG Yan-li. Image encryption based on gyrator transform
[D]. Harbin: Harbin Institute of Technology, 2009: 15-46. 张艳丽.基于Gyrator变换的图像加密研究
[D].哈尔滨: 哈尔滨工业大学,2009:15-46.

[13] LIN Rui, LIU Qi-neng, ZHANG Cui-ling. A new fast algorithm for gyrator transform
[J]. Laser Technology, 2012, 36(1): 50-53. 林睿,刘启能,张翠玲. 一种新的gyrator变换的快速算法
[J].激光技术,2012,36(1):50-53.

[14] TAJAHUERCE E, MATOBA O, VERRALL S C, et al. Optoelectronic information encryption with phase-shifting interferometry
[J]. Applied Optics, 2000, 39(14): 2313-2320.

[15] QIN Yi, GONG Qiong, YANG Xing-qiang. A method for accurate phase shift in two-step phase-shifting digital holography
[J]. Acta Photonica Sinica, 2011, 40(8): 1282-1286. 秦怡,巩琼,杨兴强.一种在二步相移数字全息中实现准确相移的方法
[J].光子学报,2011,40(8):1282-1286.

[16] REFREGIER P, JAVIDI B. Optical image encryption based on input plane and Fourier plane random encoding
[J]. Optics Letters, 1995, 20(7): 767-769.

[17] QIN Yi, ZHENG Chang-bo. Color image encryption based on double random phase encoding
[J]. Acta Photonica Sinica, 2012, 41(3): 326-329. 秦怡,郑长波.基于双随机相位编码的彩色图像加密技术
[J].光子学报,2012,41(3):326-329.

[18] REMENYI J, VARHEGYI P, DOMJAN L, et al. Amplitude, phase, and hybrid ternary modulation

modes of a twisted-nematic liquid-crystal display at 400nm

[J]. Applied Optics, 2003, 42(17): 3428-3434.

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2．王红霞 赵玮 刘长文 张瑜 刘皓淳 .基于变形分数傅里叶变换的六重密钥图像加密[J]. 光子学报, 2007,36(4): 759-762

3．陆红强;赵建林;范琦;徐莹;宛晓闯.基于像素置乱技术的多重双随机相位加密法[J]. 光子学报, 2005,34(7): 1069-1073

4．李榕;李萍.基于随机相位实值编码的光学图像加密[J]. 光子学报, 2004,33(5): 605-608

5．史祎诗 司徒国海 张静娟.级联菲涅尔衍射光学图像安全系统[J]. 光子学报, 2008,37(9): 1779-1783

6．沈丽娜 李军 常鸿森.基于联合变换相关和相移干涉的图像加密[J]. 光子学报, 2008,37(10): 2114-2117

7．黄清龙 刘建岚.用多重菲涅耳衍射变换和相位密码板实现图像加密的技术[J]. 光子学报, 2008,37(10): 2118-2123

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9．秦怡, 郑长波.基于双随机相位编码的彩色图像加密技术[J]. 光子学报, 2012,41(3): 326-329

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