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论文

波前编码双共轭梯度平方稳定解码算法及其 TMS320DM642平台的实现

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摘要:

波前编码是一种新型的光学-数字混合二步成像系统,采用三次光学编码相位板可以得到系统的非对称点扩散函数和相当景深内模糊程度一致的中间图像.本文利用空间域光学成像模型,结合反镜像边界束缚条件以及矩阵的直积分解,提出一种基于双共轭梯度平方稳定算法(Bi-CGSTAB)的图像复原算法实现波前编码系统的数字解码.该算法具有计算量小、计算速度快,几乎没有边界效应等优点.在此基础上结合TMS320DM642平台并行计算的特点,将新的算法重新优化并移植到TMS320DM642平台上.整个平台由图像采集模块、图象显示模块以及外部存储器等模块组成.通过专门设计的光学系统,分别对物距为1m、5m和10m处的物体以及人像进行成像.对中间模糊像的恢复实验结果表明,新的算法在TMS320DM642平台上图像复原速度快,效果好,为波前编码系统的真正便携和实用提供了可能.

关键词: 波前编码 三次相位板 双共轭梯度平方稳定算法 反镜像边界条件

Realization of Biconjugate Gradient Stabilized Decoding Algorithm of Wavefront Coding System Based on the TMS320DM642

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Abstract:

Wavefront coding system is a new type of optical-digital two-step imaging system. The cubic phase mask is used to get asymmetric point spread function and the intermediate blurred image which nearly the same in a considerable depth of field. Combined with spatial domain optical imaging modeland kronecker product, an image restoration algorithm which based on the Bi-CGSTAB(BiConjugate Gradient Stabilized) and antireflective boundary conditions was used in the digital decoding part of the wavefront coding system. This algorithm have advantages such as small computing amount, high computing speed and nearly no boundary effect. The new algorithm was optimized and transplanted with the characteristics of parallel computing for the platform of TMS320DM642.The whole platform consists of image capture module, image display module and external memory module. By a specially designed optical system, the experiment imaging the human and object with the object distance of 1 m, 5 m and 10 m. From the experimental result of middle blurred images, the effect of this new algorithm on the platform of TMS320DM642 is good, and it gives the possibility to realization of the truly portable and practical of the wavefront coding system.

Keywords: Wavefront coding Cubic phase mask Biconjugate Gradient Stabilized(Bi-CGSTAB) Antireflective boundary condition

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