סמינר מחלקתי

Depth of field methodology using annular liquid crystal spatial light modulator assisted by image processing

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Imaging systems' quality is defined by several parameters, among which the resolution and depth of field are of high importance. The depth of field (DOF) defines an axial range in which an optical imaging system is capable of sufficient lateral resolution. Both are controlled by the system's numerical aperture (NA). Increasing the NA improves the system's resolution, however, at the cost of lowering the DOF. In this work an optical–digital tunable extended depth of field (EDOF) methodology is presented which enables DOF extension along with minimal loss of resolution. The suggested methodology forms a fused image based on the sharpest similar depth regions (SDRs) from a set of source images taken with different phase masks. Each phase mask contains a different degree of DOF extension and implemented by using an annular liquid crystal spatial light modulator, which consists of 16 ring electrodes positioned in proximity to the pupil plane. Two known phase masks were used and a newly derived one from an optimization of the Binary phase mask for maximal DOF extension. Through a calibration procedure, the phase profiles were converted into voltage profiles. Applying those voltage profiles to the ASLM enables tuning the DOF without mechanical adjustments of the optical set up. Experimental results were investigated both qualitatively and quantitatively and the efficiency of the suggested EDOF methodology was demonstrated. In addition, the results are compared with those of some well-known fusion algorithms and proved its supremacy.

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