Compact MTF Measurement of Fisheye Lens

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In this study, we present a novel approach for the measurement of modulation transfer function (MTF) in fisheye lenses. Fisheye lenses, known for their extreme wide-angle views, pose unique challenges for MTF testing due to their complex optical properties, and the need for a large space for testing. The object of this research is to devise a compact testing setup that enables MTF analysis of fisheye lenses within a controlled environment. To achieve this objective, we designed a setup using a relay lens system that reduces the required testing space from a full room to a compact 0.5m x 0.5m x 0.5m enclosure. We show an MTF analysis on one fisheye lens within this controlled environment.

The widespread use of fisheye lenses has become a reality in modern optics, making accurate evaluation of their performance critical. However, traditional test methods for fisheye lenses often require large test benches and complex laboratory environments, which makes testing expensive and less practical. Previously there were test devices that were a cylindrical structure with a radius of 75 centimeters on which the target was placed [1] [2], the size of the test device now being used is width of at least 3 meters, height of at least 2 meters [3].

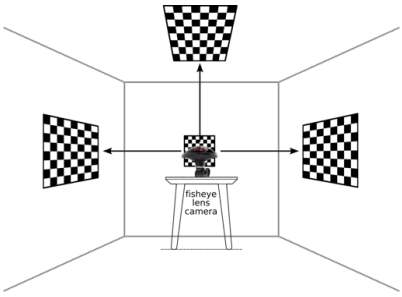

Fig 1 The current test method requires a larger space for testing with a fisheye lens.

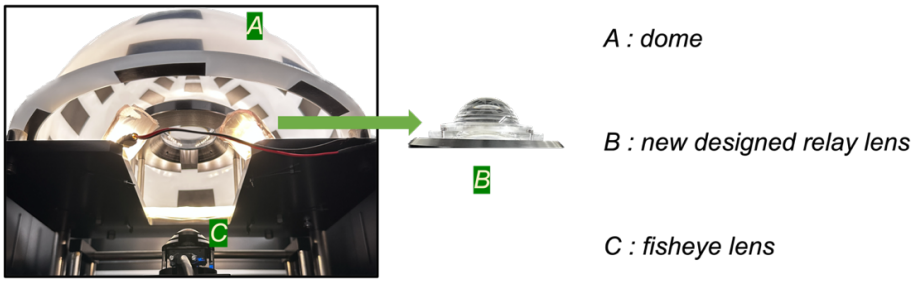

Fig 2 This is the fisheye lens experimental setup with Relay Lens already in place, and the upper dome is used to set up the test charts for the experiment.

We provide a comprehensive explanation of the Modulation Transfer Function theory, including the underlying mathematical formulas. MTF [4][5] (Modulation Transfer Function) is a capability or parameter employed to assess the performance of optical systems, such as lenses, cameras, telescopes, and similar devices.

In conclusion, our research not only addresses the specific challenges associated with fisheye lens testing but also contributes to the broader landscape of optical engineering by introducing a compact and adaptable testing solution.

References

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