Hand-Held Detector with Retro-Reflective Mosaic Screens to Visualize Optical Inhomogeneities

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Visible streaks produced by air density variations, caused by temperature changes, any gas leakage or object's moving (e.g. with supersonic speed), are an example of the Schlieren effect. In classical Schlieren photography, the light is focused with a long-focused concave mirror. This mirror returns light to the point of the radiation only if the light source is placed in the optical center, in other case light will be returned in the symmetrical point of radiation, finding which in daylight illumination is difficult. Long- focused precise concave mirrors create a non-static system and are quite expensive. For solving these problems, we created an optical system that includes: cube corner retro-reflective screen and hand-held detector, that excludes setting up process. Hand-held Schlieren detector includes a camera, light source, knife edge and TV screen. This innovation makes the Schlieren method mobile and user-friendly. In the method offered by us, we use cube corner retro-reflective screen, on which retro-reflective elements are placed on the plate surface. For this type of cube corner, retro-reflector screen tautochronism feature is not characterized. This cause reducing brightness of the received image. To solve this problem, we decompose the vertices of the prisms on a second-order surface (equation was obtained by mathematical calculation). Retro-reflective screen modified by us: • Always reflects light exactly to the radiation point. • Cheap • Has tautochronism feature • Is not a characteristic spherical aberration, coma and astigmatism. Thus with our innovation, the usage of Schlieren method widened and can be used in heat transfer, leak detection, aerodynamics and other optical applications.

Awards Won:
Fourth Award of $500
SPIE, the international society for optics and photonics: First Award of $2,500