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# Design and testing of a compact non-orthogonal two-axis Lloyd's mirror interferometer for fabrication of large-area two-dimensional scale gratings

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Highlights of this paper:

- An optical setup is designed for fabrication of large-area scale gratings.
- The design is based on non-orthogonal 2D Lloyd's mirror interferometer.
- Grating pattern structures have been estimated by computer simulation.
- A 100 mm×100 mm 2D scale gratings has successfully been fabricated.
- 2D grating patterns with a short period of 1 μm has been fabricated.

**Abstract:** A compact and stable two-axis Lloyd's mirror interferometer based on a new non-orthogonal type of mirror-substrate assembly is designed for fabrication of 100 mm×100 mm large-area two-dimensional (2D) diffraction scale gratings in a research laboratory or a small-scale manufacturing facility. At first, the required mirror sizes used in the new non-orthogonal type and the conventional orthogonal type are compared based on geometrical analysis. It is identified that the width of the mirror can be reduced to half in the non-orthogonal type while the required mirror height and the expanded laser beam diameter are comparable to those in the orthogonal type. The shorter mirror width makes it possible to design a compact mirror-substrate assembly so that the overall interferometer can be realized in an overall size of 1480 mm×730 mm for mounting on a commercially available general-purpose 1500 mm×1000 mm vibration isolation table for use in research laboratories. It is then verified by simulation that the selected laser source and the designed beam expansion assembly, which are the other main parts of the interferometer, are effective for fabricating the designed grating structures. Experiments are also carried out to demonstrate