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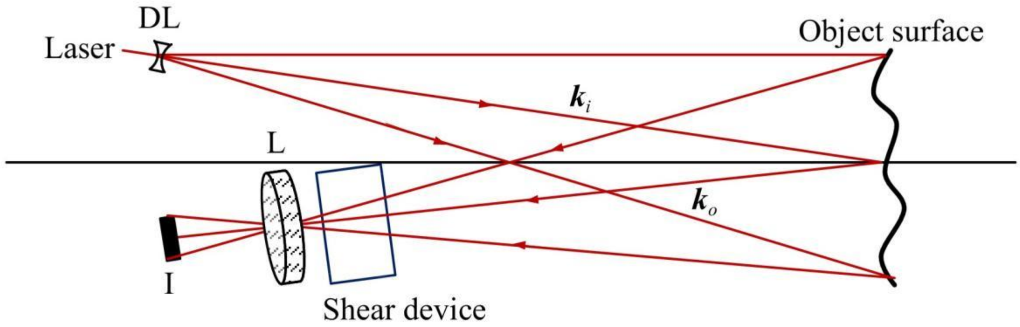
LAM | Latest publications

Light: Advanced Manufacturing published one review and two articles

1. LAM review | Shearography and its applications – a chronological review

Shearography is a displacement gradient sensitive, full-field optical technique that is resilient to environmental disturbances and vibrations and is capable to examine large structures. It can be used on shopfloor as well in field. The major application of the technique is the non-destructive inspection of laminates. It has been applied to examine components and systems in aerospace and automobile industries, and to inspect art objects like paintings for conservation. The review article presents the evolution of the technique, various optical configurations, recording procedures, and applications.



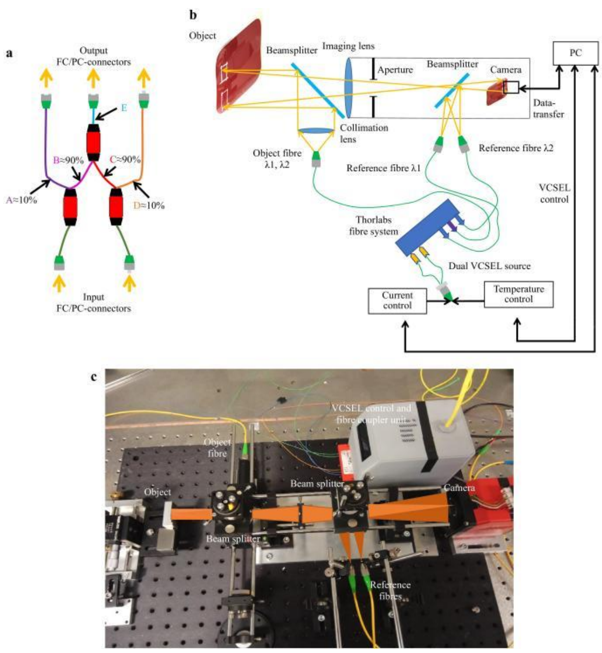
Caption | Schematic of a speckle pattern shear interferometer: DL-diverging lens; L-imaging lens; I-image sensor.

See the article:

Rajpal Sirohi. Shearography and its applications – a chronological review[J]. Light: Advanced Manufacturing. doi: https://doi.org/10.37188/lam.2022.001

2. LAM article | Snap-shot topography measurement via dual-VCSEL and dual wavelength digital holographic interferometry

A spectrally highly stabilized dual VCSEL-source shows great potential for the application in optical metrology. This relates in particular to snap shot recovery of the topography data of an entire area even at non-cooperative surfaces that specular and/or diffuse reflective. State of the art metrology techniques, which can cope with these types of surfaces are white light interference microscopy and confocal microscopy. However, the measurement is very time-consuming ranging from multiple seconds to minutes. Dual wavelength holography can overcome the aforementioned shortcomings. The measurement range and the axial resolution can be adjusted via the choice of the dual wavelength pairs. The measurement uncertainty in dual wavelength holography is strongly linked to a stable wavelength difference between the two wavelengths employed down to a few picometers or even sub-picometers only. VCSELs are particularly well suited for this application since they show a reduced temporal sensitivity compared to edge emitting diodes combined with excellent coherent properties. Therefore, a VCSEL based picometer stabilized dual wavelength source has been configured and has successfully been applied to investigate various objects exhibiting different surface properties.



Caption | **Experimental setup**

a Schematic presentation of ILM designed fibre system, where fibres A and B correspond to the reference- and object-fibre of the first VCSEL, D and C the reference- and object fibres of the second VCSEL, E the combined object-fibers from object-fibers of the first VCSEL B and second VCSEL C, **b** schematic implemented setup, **c**

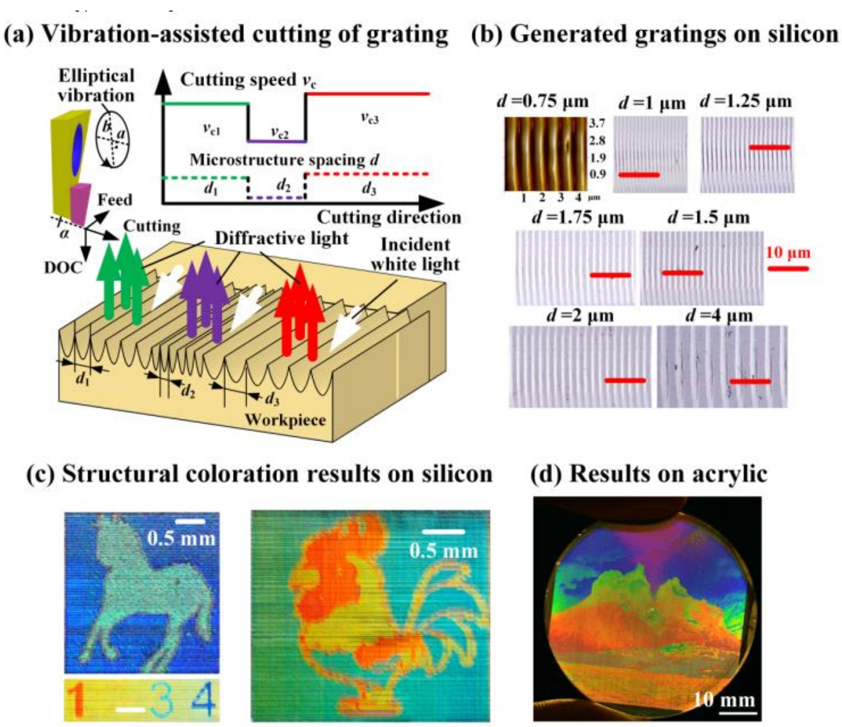
experimental setup with a step object of sequentially reduced step size.

See the article:

Daniel Claus, Igor Alekseenko, Martin Grabherr, Giancarlo Pedrini, Raimund Hibst. Snap-shot topography measurement via dual-VCSEL and dual wavelength digital holographic interferometry[J]. Light: Advanced Manufacturing. doi: https://doi.org/10.37188/lam.2021.029

3. LAM article | Structural coloration of non-metallic surfaces using ductile-regime vibration-assisted ultraprecision texturing

Due to the intrinsic brittleness of silicon, it is extremely difficult to machine silicon in plastically remove material to create a crack-free surface finish, much less generate a micro/nanostructured surface. Scientists from China and USA now report a ductile-regime ultraprecision texturing process of silicon by optimizing the trajectory of a h-frequency elliptical vibration added on the diamond cutting tools. The team successfully demonstrate structural coloration on silicon by creating programmable and pixelated diffraction gratings.



Caption | Structural coloration of non-metallic material using vibration-assisted cutting.

a, The schematic principle diagram of vibration- assisted cutting of diffractive gratings for structural coloration. During vibration texturing, pixelated patches of the gratings with various spacings can be created by dynamically modulating the nominal cutting velocity at each interval. Two types of optical systems were used to observe and record the structurally colored workpiece surfaces, after machining based on the different transparencies of silicon and acrylic. The silicon was measured in a reflection configuration, whereas the acrylic sample was characterized using a transmission setup. **b**, The surface morphology of generated grating on silicon. (Cutting condition: vibration frequency of 2 kHz, nominal cutting velocity = 2–8 mm/s corresponding to feature spacings of 0.75–4 µm). **c**, The image rendering results of a horse, a rooster, and digits with an illumination angle of 45° (red scale bars = 0.5 mm, pixel size = 20 × 20 µm). **d**, The structural coloration results on acrylic (pixel size = 20 × 20 µm, illumination angle of 45°).

See the article:

Jianjian Wang, Yaoke Wang, Jianfu Zhang, Yang Yang, Ping Guo. Structural coloration of non-metallic surfaces using ductile-regime vibration-assisted ultraprecision texturing[J]. Light: Advanced Manufacturing. doi: https://doi.org/10.37188/lam.2021.033

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