based on MS-DWS*

Technology

Adaptive Speckle Imaging Interferometry

Measurement Principle

1. What is a Speckle Image?

When a laser illuminates a sample, the light diffuses into the sample, and encounters objects (particles...etc) that backscatter light as interfering waves. By using a videocamera as a detector, an interference image called 'Speckle' is displayed.



Thin layer sample Scatterers = Particles, fibers, droplets,... that scatter laser light



Speckle image = interference image

Deformation of speckle pattern

Moving

scatterers



Case of a Fluid Sample

If scatterers in the sample are moving particles (ex: brownian), the motion induces light intensity fluctuations of the speckle spots, and an overall deformation of the speckle pattern.





Deformation

Case of a Film-Forming Sample

As the film progressively forms, the motion of the scatterers slows down, due to an increase in the film viscosity. As a consequence, the speckle deformation speed decreases as the sample dries.





[PATENTED]

A.S.I.I. Processing

1. 'Speckle Rate' Determination

Speckle rate = deformation speed of the speckle pattern due to the scatterers motion in sample



How to quantify the deformation speed of the speckle pattern ?

To quantify the deformation speed of the speckle pattern and plot the speckle rate as a function of time, successive speckle images are acquired over time **T** using a video-camera.



T = acquisition time of speckle images

The speckle images are then processed to determine the **decorrelation time** τ corresponding to a relevant speckle pattern deformation. The speckle rate is obtained as the inverse of time τ , and one point is plot on the kinetics.

Speckle rate = $1/\tau = 1/decorrelation$ time of speckle images

2. Adaptive Processing

As the film progressively forms, the scatterers motion decreases and so does the deformation speed of speckle pattern. The acquisition time **T** is continuelly optimised to achieve the best measurement of high and low speckle rates, *i.e.* to ensure **accuracy** and **responsiveness**.



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