

The VIC-3D™ Stereo Microscope Measurement System

by Correlated Solutions, Inc.

VIC-3D™ Micro by Correlated Solutions, Inc. utilizes an established measurement technique known as Digital Image Correlation (DIC) to measure three dimensional surface shape, deformation, and strains of microscopic specimens. This unique system utilizes a patented stereo microscope distortion correction software module which removes complex non-radial optical distortions that can severely bias strain measurements.

Background

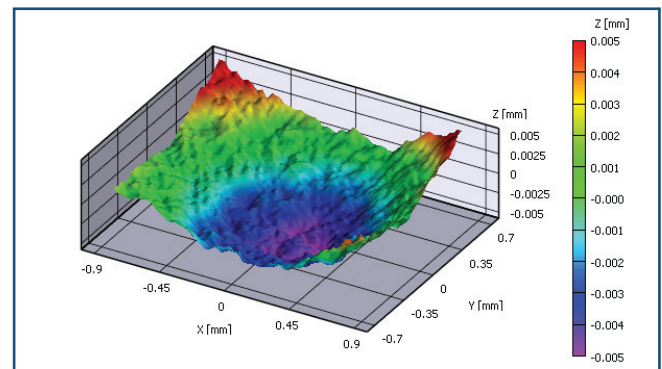
3D DIC has found widespread popularity for strain measurements due to its excellent accuracy, robustness, and ease of use. Recently 3D DIC has found more application in measurements that require high magnification, but due to the lack of suitable optics that provide sufficient depth-of-field, it has shown to be extremely difficult to achieve accurate data. Stereo microscopes appear ideally suited to provide these measurements, but present many challenges.

Challenge

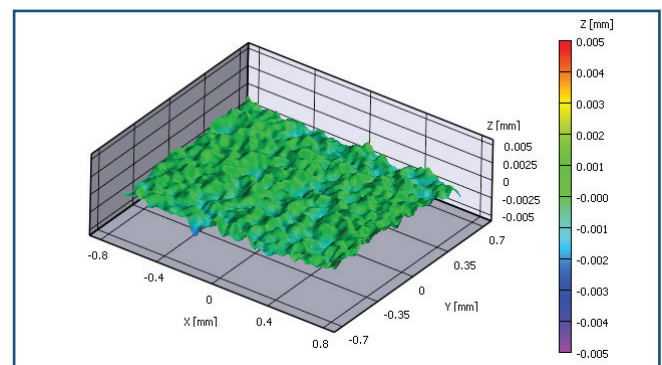
The complex optical system of stereo microscopes prevents proper calibration of image distortions using traditional models such as Seidel lens distortions. Because of this, the data typically contains severely biased shape and strain measurements. In this case it is not uncommon to observe bias levels of several thousand microstrain.

Solution

To overcome this challenge, Correlated Solutions, Inc. has developed a simple to use calibration method that does not suffer from the problems associated with the traditional parametric distortion models that are commonly used. The calibration method uses a planar object with a speckle pattern to compute the non-parametric distortion fields of the stereo microscope and has been shown to completely eliminate shape and strain bias from the measurements.



Shape data of an optical flat without distortion correction



Shape data of an optical flat after distortion correction

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Turn-key System Standard Components

- VIC-3D & VIC-2D Digital Image Correlation Software, VIC-Snap image acquisition software, + 1 post-processing license (provided on a USB dongle)
- VIC-3D Stereo Microscope Distortion Correction Software Module
- Quad-core PC, desktop or laptop
- Two 5.0 megapixel digital cameras (high speed available)
- Stereo microscope with zoom body & objective lens
- Custom designed optical beam splitter
- Custom designed calibration fixture
- 3-axis motorized stage
- Fiber optic lighting system with ring light
- Airbrush system for specimen preparation
- All cables and accessories
- Three hard-sided protective carrying cases
- 2 Day on-site training seminar
- Tech support and software upgrades for 1 year
- Custom mounting available

The VIC-3D Microscope Hardware Features

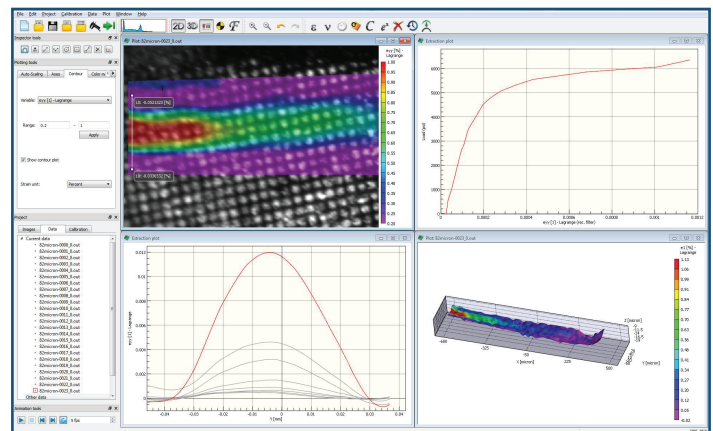
- Precise and computerized 3-axis stage movement for easy focusing and positioning
- Flexible zoom range
- Independent CCD adjustability for optimized image overlap and focusing
- Automatic system calibration with provided fixture
- Integrated ring light for diffuse specimen illumination
- High-quality airbrush painting system for easy specimen preparation

Services, Support, & Warranty

- On-site installation and training services
- Unlimited technical support via phone and email for one year
- One year hardware warranty

Field of View Range	0.7mm - 8mm
In-plane Displacement Resolution	down to $\pm 10\text{nm}$
Out-of-Plane Displacement Resolution	$\pm 120\text{nm}$
Strain Resolution	$\pm 0.010\%$
Camera Resolution	up to 5MP*
Camera Frame Rate	up to 2,000fps*
Stage Translation Range	100 x 100 x 50mm
Motorized Stage Movement Step	1 μm
Image Correlation Processing Speed	up to 80,000 pts/s

*Camera resolution and frame rate vary upon configuration



Screen shot of the VIC-3D Microscope system's workspace showing the strain field of a microscopic solder sample under tensile loading

The VIC-3D Microscope Software Features

- Accurate full-field 2D and 3D measurement of shape, displacements, and strains of the test article
- User friendly data inspection tools
- Customizable coordinate system
- Flexible data extraction of statistics, time-history from points or regions, line-slices, and much more
- Apply Function feature allows user defined equations to be entered
- Precise node data extraction for FEA comparison / validation
- Point cloud data exporting in common formats

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