Application Note AN-610

Distortion Correction in Vic-2D

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SOLUTIONS

Introduction

The distortion correction module in Vic-2D uses an inverse mapping technique to correct for the complex distortions present in a single camera microscope imaging setup. The distortion correction module can also be used to correct distortions for other situations, like high distortion lenses and viewing through windows.

Necessary equipment/software

A speckle pattern large enough to fill the entire field of view will be necessary for the inverse mapping step. If the speckled region of the specimen is large enough and if the pattern quality is good, you may use the specimen for the distortion correction/inverse mapping.

Finally, a current version of Vic-2D must be installed. This requires the installation of a software key license or a hardware key with the correct module present.

Acquiring distortion correction images

The distortion calibration will only be valid for a specific aperture, focus, camera geometry and zoom level, so these should be fixed before calibration begins. Also, if viewing through a window or medium, that window will become part of the calibration, so that must remain fixed in reference to the camera as well.

Additionally the distortion pattern must be in the same plane as the specimen. Set the aperture to a value that provides enough light and beware apertures that are too small; the image may become blurred due to diffraction limits in the optics. This limit will vary depending on magnification and camera selection, so check the image carefully, zooming in if necessary.

To begin, place the speckle pattern in the imaging field, and position the field of view so that the pattern covers it completely.

Check that focus and lighting are good across the pattern. An example of a speckle image is shown below.
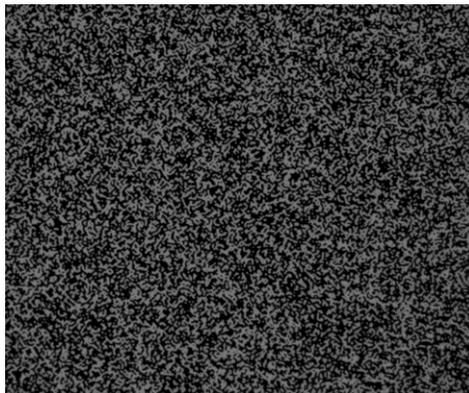
Take a starting image. Then, take a sequence of images which contains in-plane motion. A good sequence is shown below:
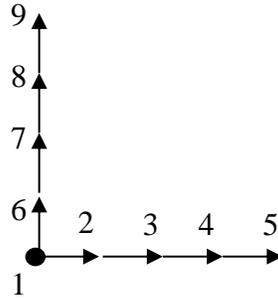
The total motion should be approximately 15% of the field of view, which means each step in the sequence above will be approximately 4% of the field of view. It is very important that the motions are in the exact plane of the pattern itself.

Analyzing distortion in Vic-2D

Start Vic-2D and import the distortion speckle images by selecting *Project… Speckle Images*. First an analysis is run without the distortion correction by selecting *Data… Start analysis*. To calibrate for distortion correction, select *Calibration… Distortion correction*. You will see a window similar to the window below.
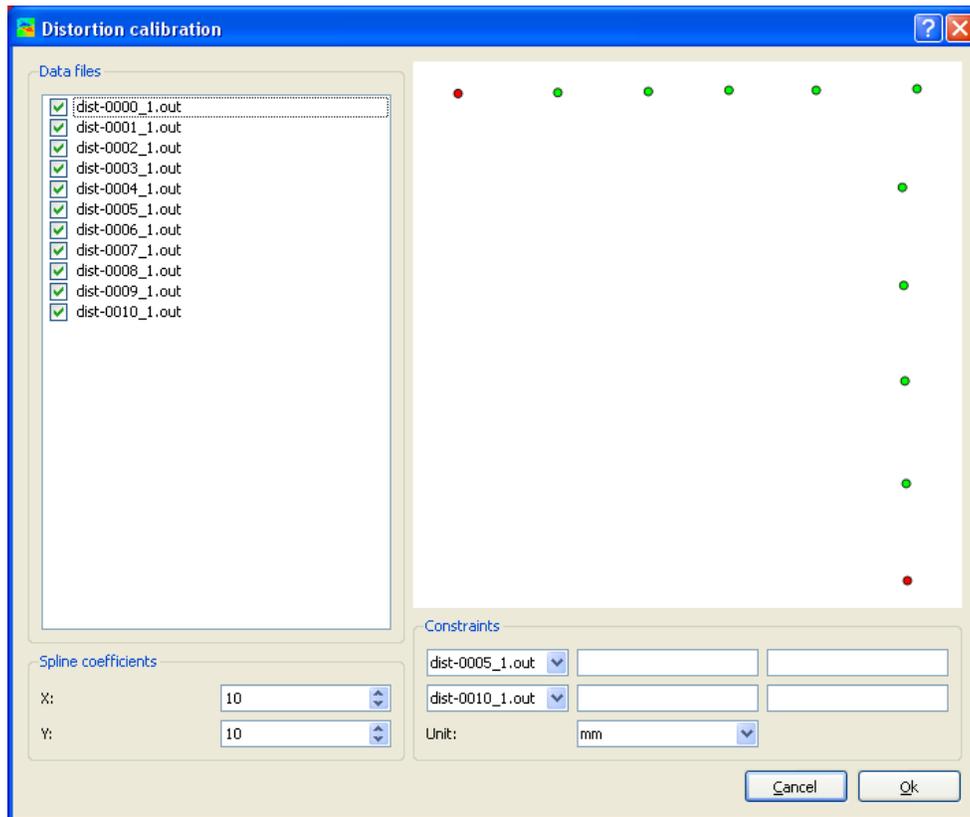

Here we see that the largest horizontal motion occurred at dist-0005 and the largest vertical motion occurred at dist-0010. After noting where the maximum horizontal and vertical motions occurred, exit out of the distortion correction, click the data tab and

select, in this case, dist-0005.out. Right click on the contour graph and select the horizontal pixel displacement, *u*. You will see something similar to below:
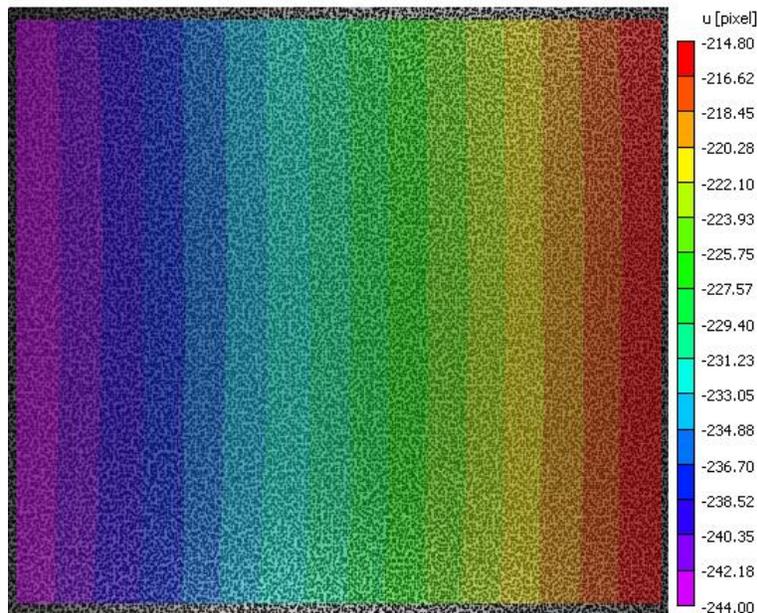
Right click on the plot and click "view statistics." This will tell you that the average/mean motion here was -229.40 pixels. Similarly, we investigate the vertical pixel displacement, *v*, for dist-0010.out.
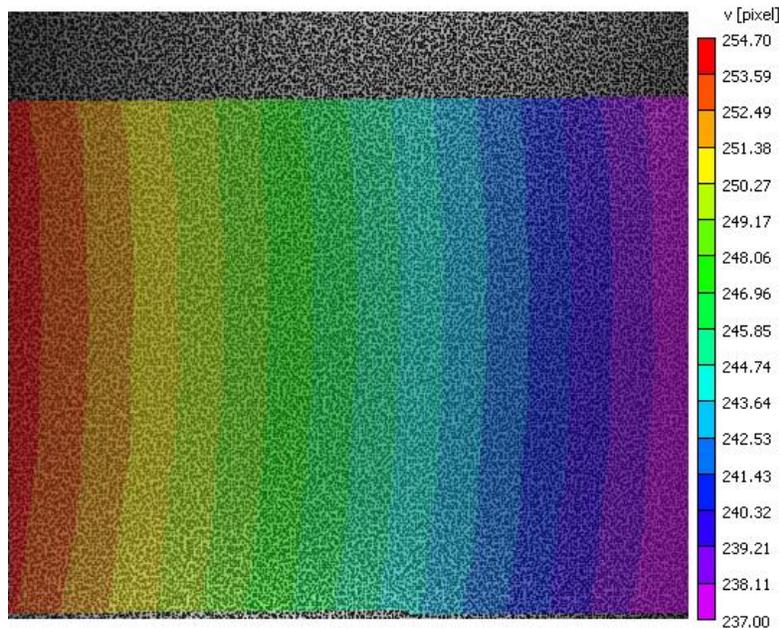
Note that the average vertical displacement was about 245.85 pixels.

Next, the pixel values should be converted into distance. Since the camera here has 2448 pixels across and is a 1.8 mm field of view, the distances are .735 microns per pixel. The -229.40, -245.85 pixel coordinates are converted to -.169, .181 mm. If you know how much the stage physically moved in inches or mm (with very good precision), you can also enter those values instead.

In the *Distortion calibration* window, enter the xy coordinates of dist-0005 (-.169,0) and dist-0010 (0,-.181).   Press *Ok*. You should see a window that verifies that the distortions were successfully computed.

Analyzing test images in Vic-2D

At this point, you may add your speckle images to the project and run as normal. The inverse mapping calibration will be applied to the images before processing.

Support

If you have any questions about this Application Note or any other questions, comments, or concerns about your CSI system, please feel free to contact us at support@correlatedSolutions.com or visit our web site at www.correlatedsolutions.com.