

## **Abstract**

An electronic speckle pattern interferometer (ESPI) is one of optical non- destructive techniques which is used to find out a displacement in a micrometer scale due to the applied load on the sample or by its movement. In this work the Out-of Plane Displacement was measured by designing a simple setup of ESPI depending on the principle of Michelson Interferometer.

Using this design and utilizing an image processing technique, a displacement in the z-direction of different Pure Titanium Grad 1 samples was measured that caused by applying a tension load upon it. An Out-of Plane Displacement of the sheep Rib Bone was measured also due to its movement as another sample type. The measured displacement cannot be noticed by a naked eye. An ESPI is a very sensitive, non-destructive, noncontact, and full field imaging tool for detecting a small displacement/deformation by utilizing a fringes pattern.

Fringes pattern resulted by a digital subtraction of two speckle patterns that imaged on a Charge Coupled Device (CCD) camera, a reference speckled interference pattern and a speckled interference pattern when the sample is displaced.