

## A NON-CONTACT APPARATUS AND METHOD FOR MEASURING SURFACE STRAIN IN A MATERIAL

### IITM Technology Available for Licensing

#### Problem Statement

- Non-contact methods, such as **Digital Image Correlation (DIC)**, are being used to measure **strain** in materials.
- However, DIC faces **challenges** related to **specimen preparation**, **imaging equipment**, and **algorithm complexity**.
- Existing strain measurement systems fall short** when faced with **complex non-uniform deformation patterns** and **heterogeneous materials**.
- There is a need for a reliable non-contact apparatus and method for measuring surface strain comprehensively while capturing strain behavior across diverse scenarios and materials.

#### Intellectual Property

- IITM IDF Ref. **2454**
- IN 536878 - Patent Granted**

#### TRL (Technology Readiness Level)

TRL 4 Technology Validated in Lab

#### Technology Category/ Market

Category- Non-Destructive Testing Methods & Equipment (NDT/NDE)

Industry Classification:

- **NIC (2008)- 26511-** Manufacture of physical properties testing and inspection equipment; **71200-**Technical testing and analysis.

- **NAICS (2022)- 541350-** Building Inspection Services; **54138-** Testing Laboratories and Services

**Applications-** Structural integrity assessments, material characterization and deformation analysis in real time of bridges, buildings and other applications where precise strain measurement is required.

**Market report:**

- The Global building inspection services market is expected to grow at a CAGR of over 10% during the forecast period of 2023-2027.

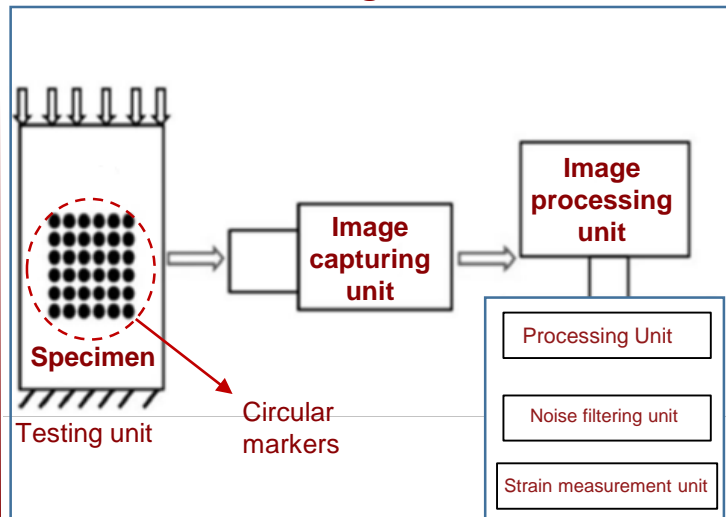
- The global strain gages market size was USD 1230.6 million in 2023 and market is projected to touch USD 1665.3 million by 2032, with a CAGR of 3.4%

- The global market for Fiber Optic Sensors was at USD 3.1 Billion in the year 2022, is projected to reach USD 6.4 Billion by 2030, growing at a CAGR of 9.5%

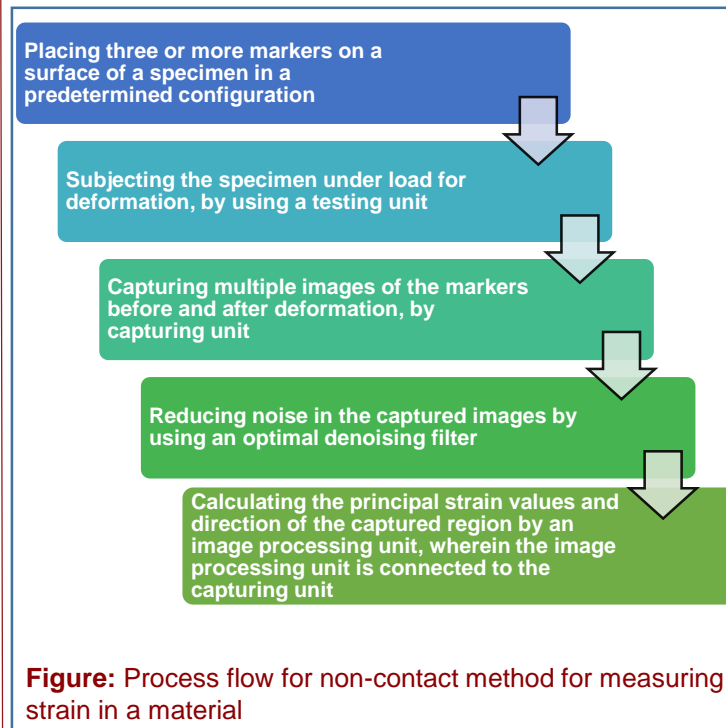
- The global DIC market was USD 243 million in 2023 and is projected to reach USD 350 million by 2033, with a CAGR of 3.7%

#### Research Lab

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**Figure:** Apparatus for a non-contact method for measuring strain in a material in accordance with an embodiment.



**Figure:** Process flow for non-contact method for measuring strain in a material

#### CONTACT US

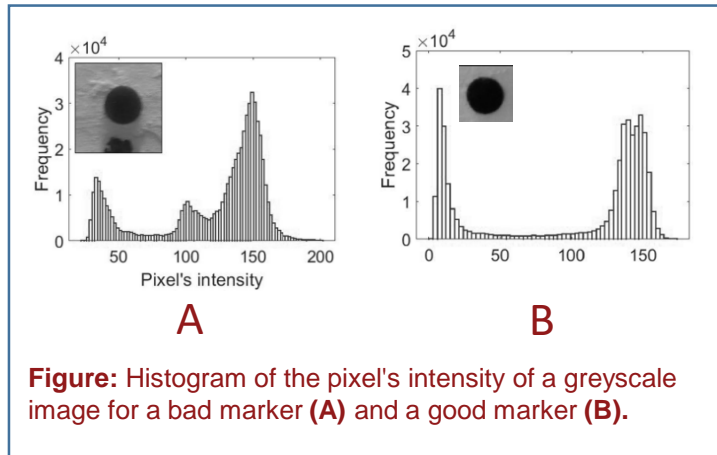
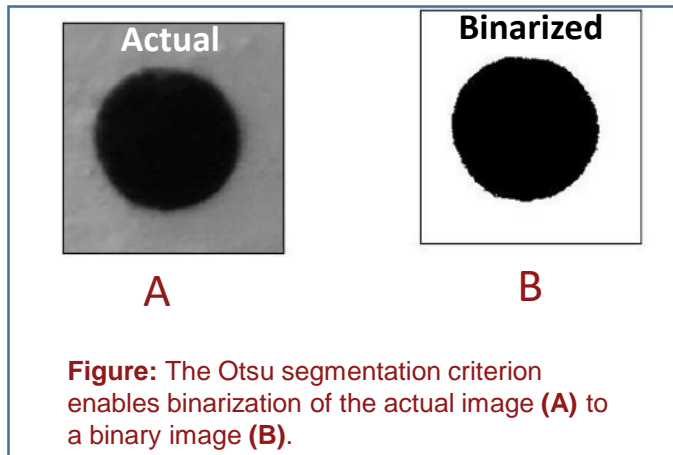
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### Technology

The method begins with the strategic placement of markers on the surface of a specimen, followed by subjecting it to controlled deformation through a testing unit

Images of three or more markers are captured before and after deformation using a capturing unit

An image processing unit comprises a processing unit within this framework identifies and calculates displacement vectors of the markers, extracting pivotal information about their movement.

To enhance accuracy, a noise filtering unit systematically reduces noise within these displacement vectors through an optimally designed Gaussian filtering technique

Strain measurement unit further refines the data, generating principal strain values and direction that comprehensively characterize material behavior

### Key Features / Value Proposition

- The innovation offers a robust and cost-effective solution, eliminating the need for intrusive instrumentation and simplifying the strain measurement process.
- The Gaussian filter for noise elimination used in the invention helps in symmetrical characteristics around the mean, gradual reduction of kernel weight, and absence of additional peak formation with higher spread parameters. In the presence of Gaussian-like noise, this filter outperforms alternative low-pass filters.
- The method's effectiveness is demonstrated through experimental investigations on plain concrete cylinders subjected to cyclic loading. The compatibility of the non-contact approach with traditional strain measurement methods reinforces its reliability and applicability in real-world scenarios.
- Traditional contact methods can introduce perturbations to the material's behavior while needing intricate instrumentation setup; whereas, the non-contact approach minimizes such disturbances, preserving the material's natural response using only regular cameras and markers for real time measurement with reduced complexity and cost.
- It enables strain measurements in multiple directions simultaneously in hard-to-reach or hazardous environments, thus providing comprehensive insights into material behavior, enhancing safety and accessibility.

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