The 3rd ICMSc 2021

FMIPA UNMUL

International Conference On Mathematics and Sciences

Physics Laboratory by Video Tracker and Visual Basic for Application at Home During Covid-19 Pandemic: Material Elasticity Measurement

Presented by

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Room Theater, Science Learning Center Building FMIPA UNMUL, 12th October 2021

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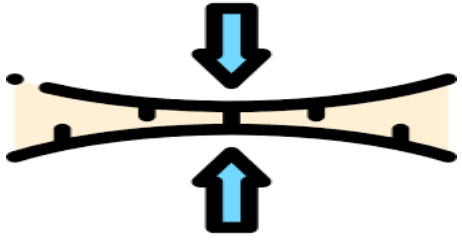
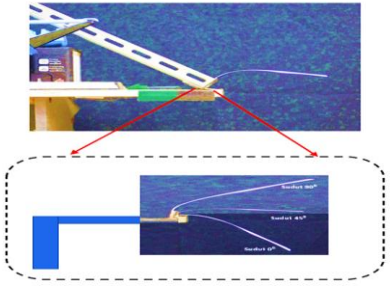
Outline

1. Introduction

2. Proposed Approach



3. Experimental

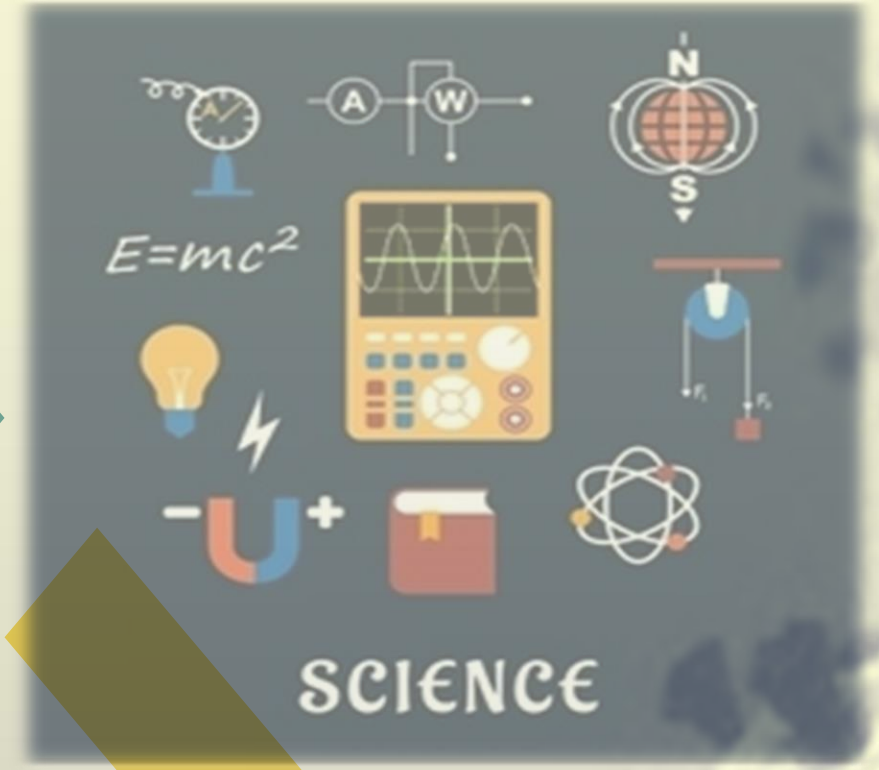


4. Results and Analysis

5. Conclusion

Introduction

Coronavirus (COVID-19) disease is an emerging situation that brought challenges to all sectors, including academia and research.



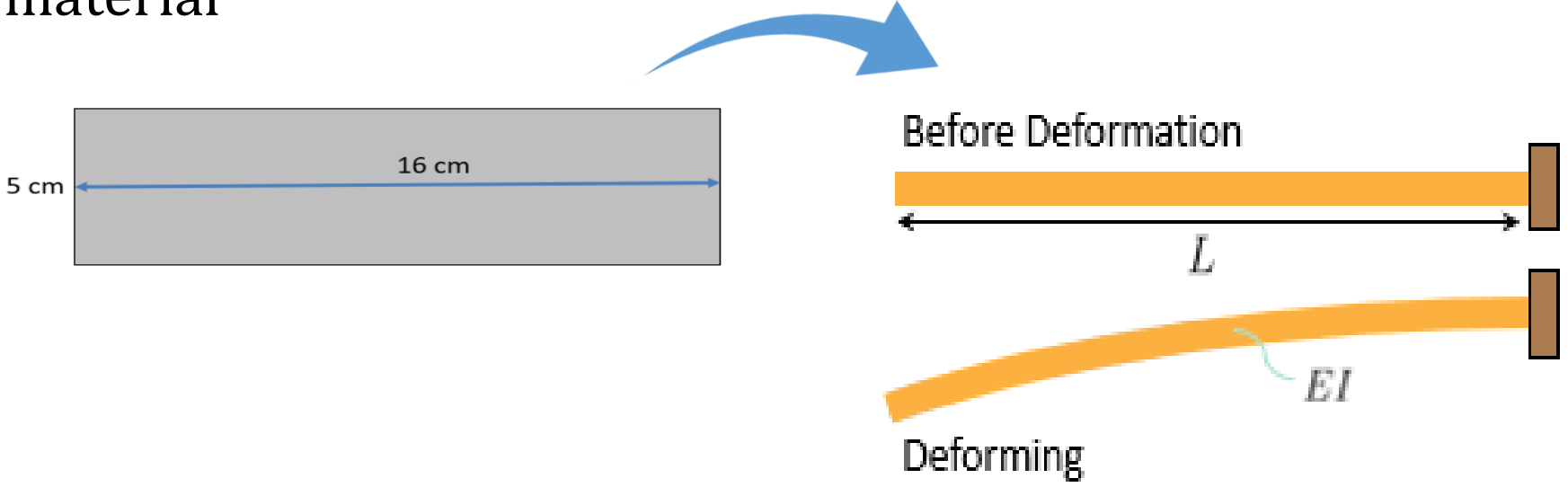
Physics laboratory at home

Tracker

Video Analysis and Modeling Tool

Proposed Approach

We investigated application of video tracker for Physics Laboratory: elasticity modulus measurement of sheet-shaped material



Proposed Approach

We present a novel approach to calculate modulus elasticity for sheet-shaped material from known image tracking using video tracker software.

The method is very potential for developing new equipment for determining elastic modulus with very simple procedures without damage the material.

Experimental Details

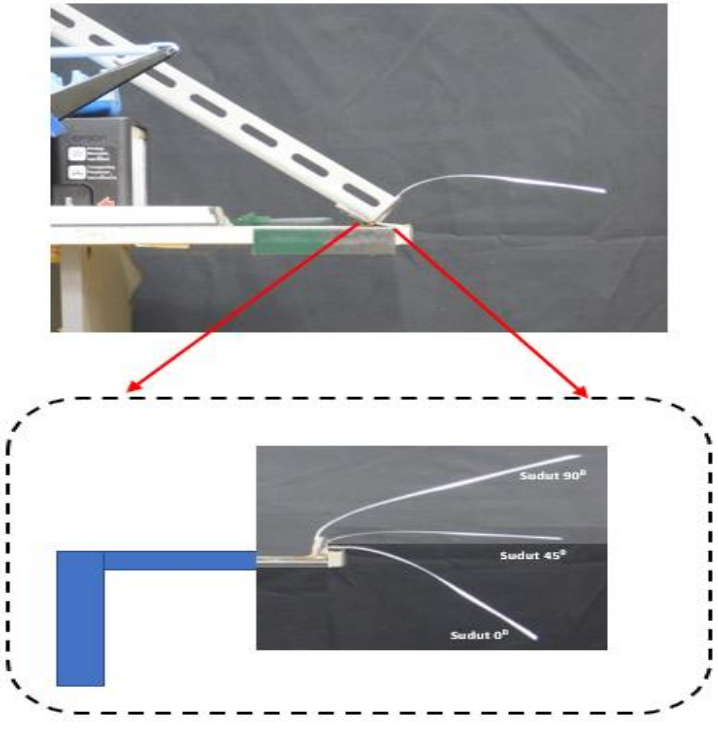


Fig.1. Illustration of a Simple Experiment Measurement Elasticity Modulus for Copy Paper 100gsm

Experimental Details

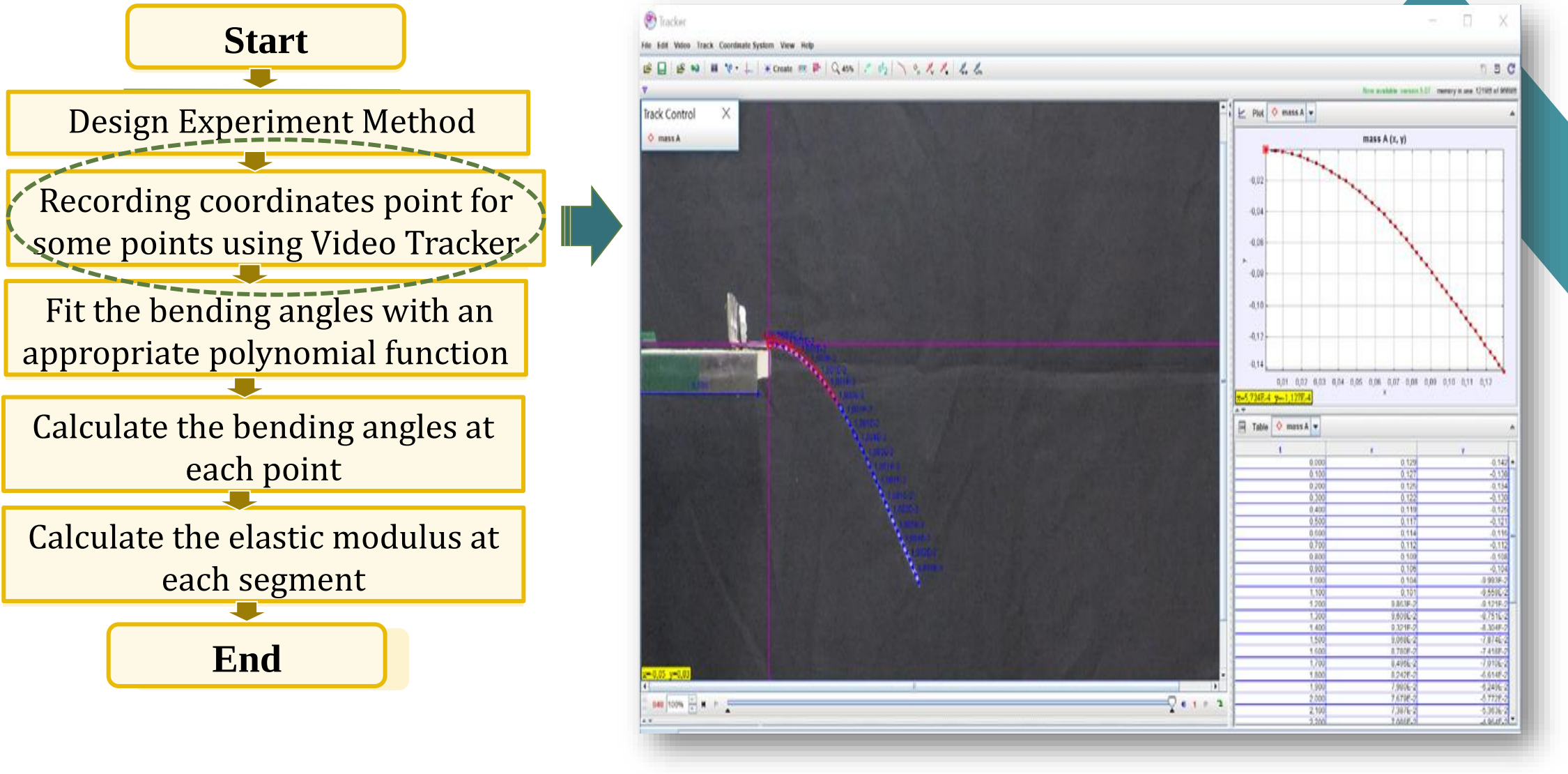


Fig. 2. Procedure for estimating the elastic modulus of the beam

Results and Analysis

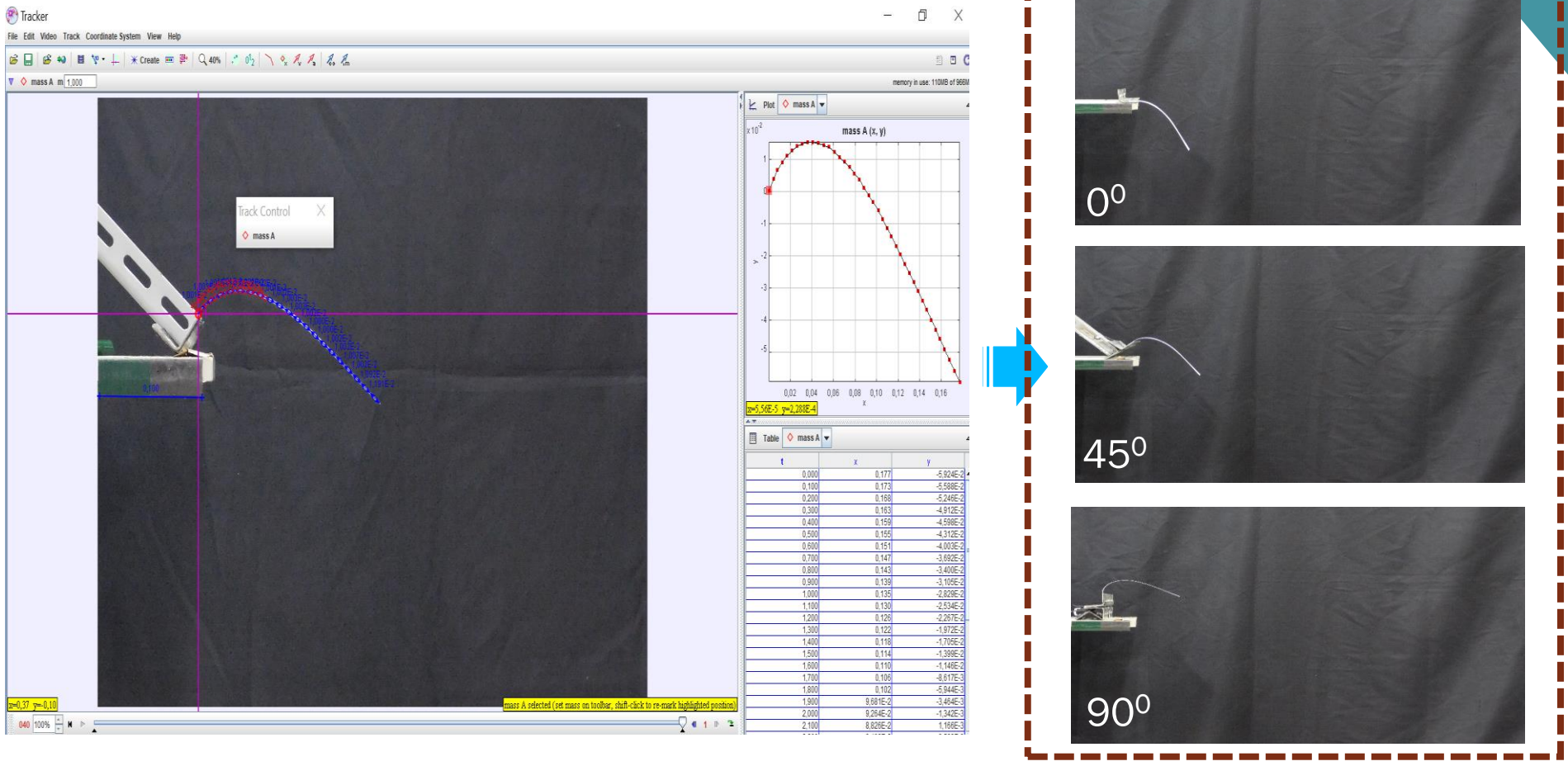


Fig. 3. Display video tracker when tracking mass points for curvature angle 0^0, 45^0 dan 90^0.

Results and Analysis

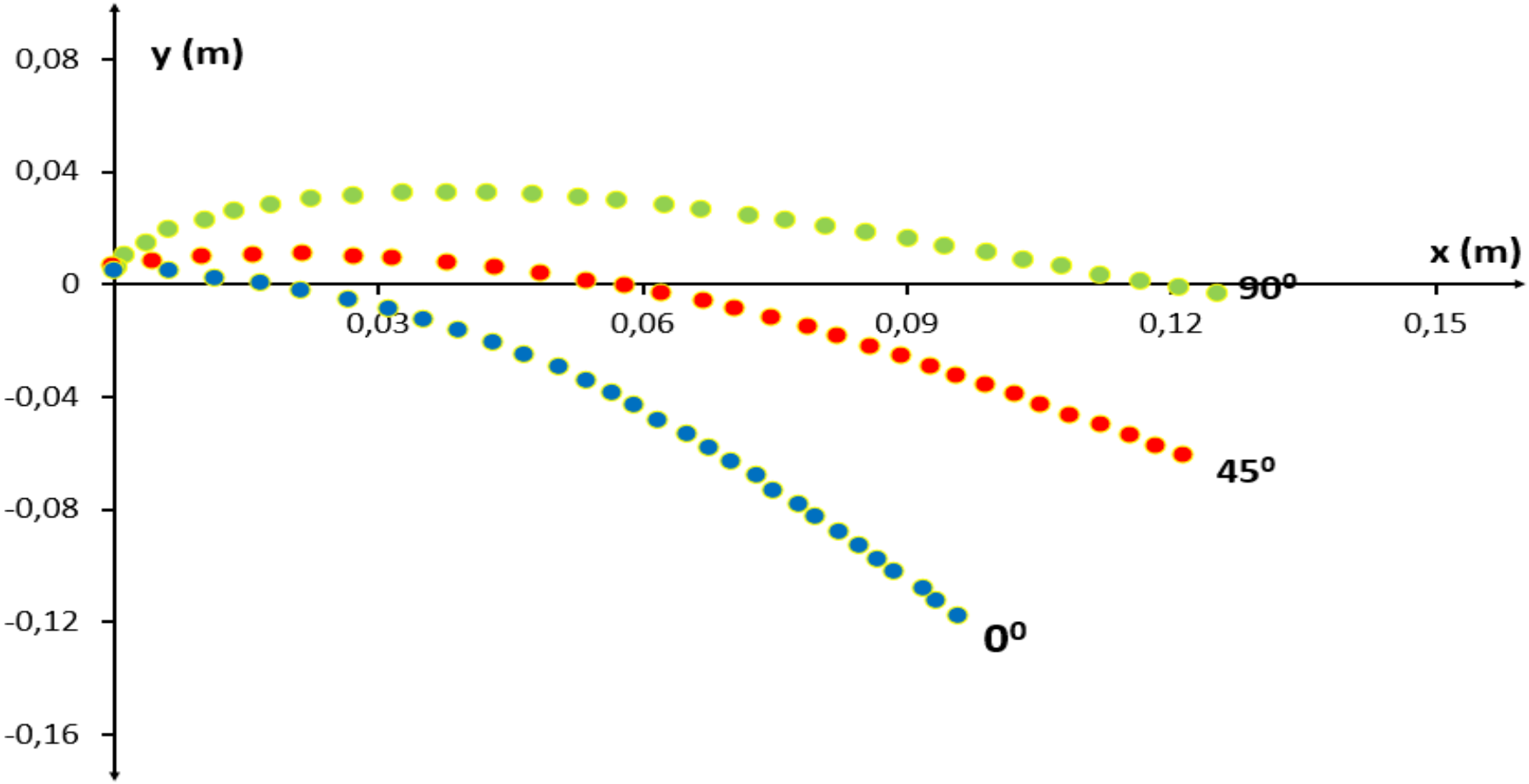
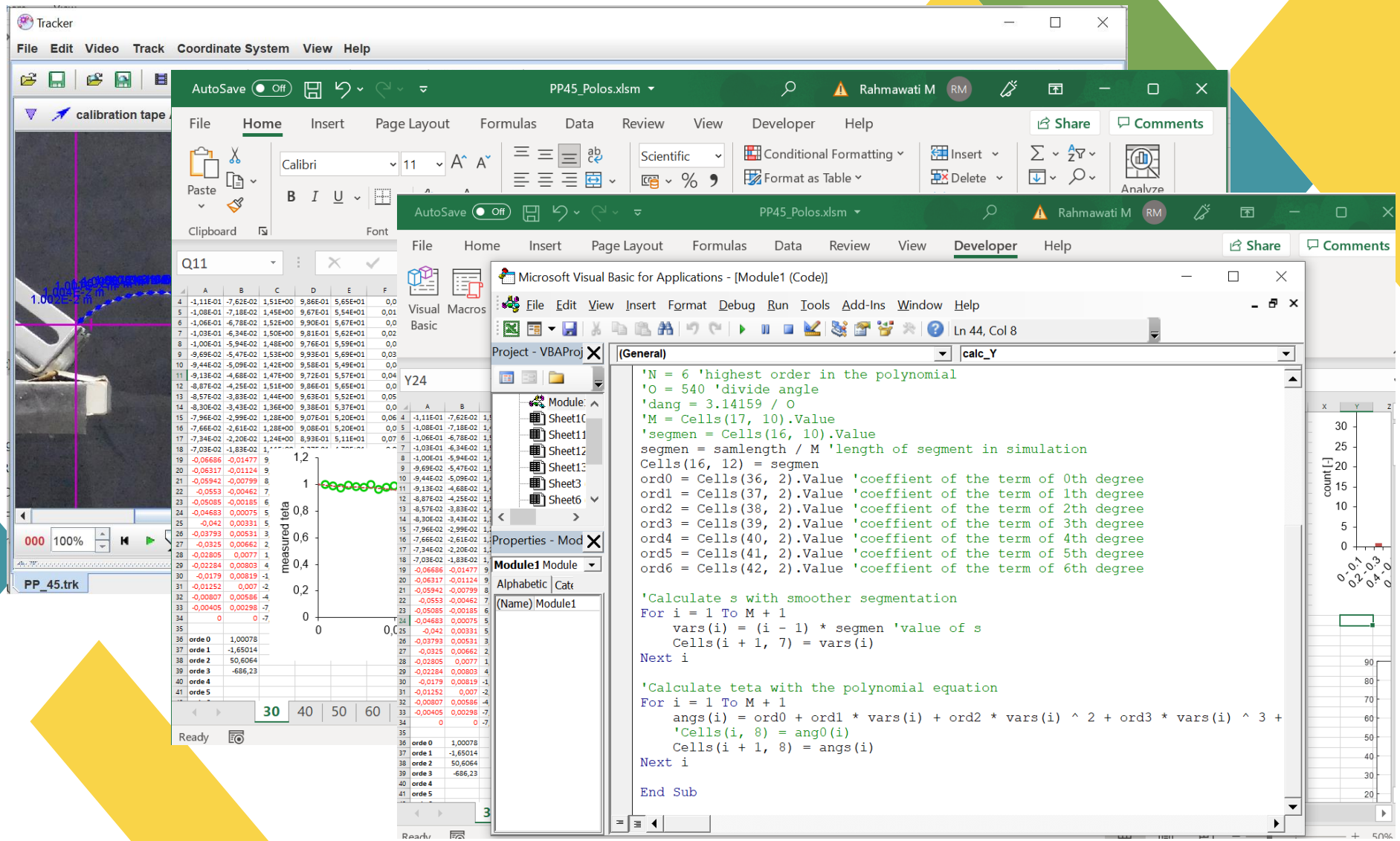


Fig. 4. The deflection profile of the results of the image through image tracking using a video tracker for sheet-shaped samples.

“ How to Calculate?



How to Calculate?

Calculate angle of each segment

$$\theta_j = \theta_{j-1} - \frac{a^3 g}{E_j I_j} \sum_{i=1}^{j-1} \left(\sum_{k=1}^{i} cos\, \theta_i \right)$$

Calculate coordinates of each segment

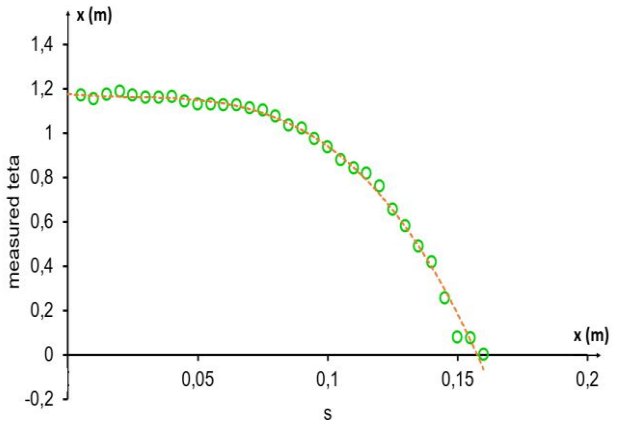
$$x_j = x_{j-1} + a \cos \theta_j \qquad y_j = y_{j-1} + a \cos \theta_j$$

Calculate Young's modulus of each segment

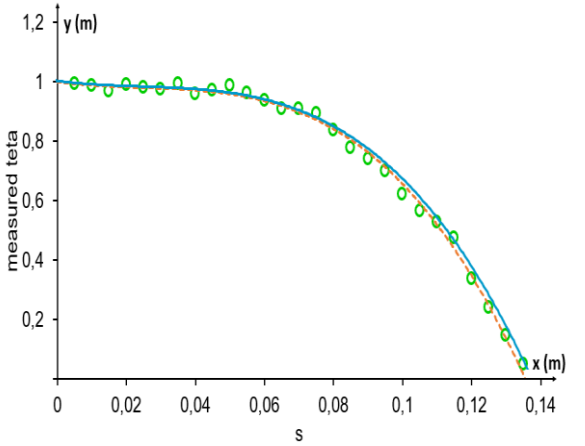
$$E_j \approx -\frac{a^3 g}{I_j \left(\Theta_j - \Theta_{j-1} \right)} \sum_{i=1}^{j-1} \left(\sum_{k=1}^{i} \lambda_k \right) \cos \Theta_i$$

Results

Curvature angle 0^0



Curvature angle 45^0



Curvature angle 90^0

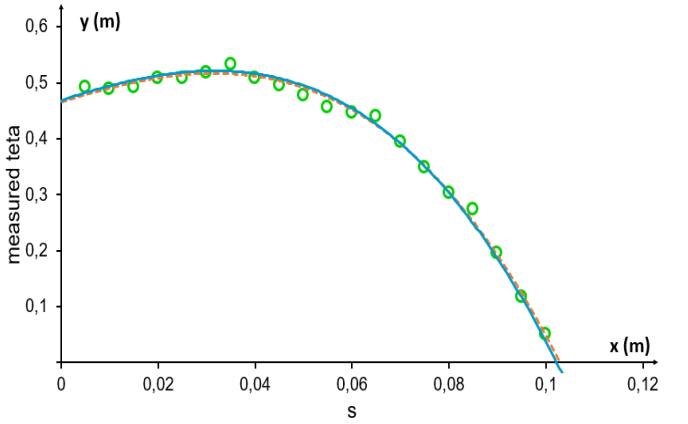


Fig.5 Experimental data fitting graph (green colored round shape), theory (orange dashed line) and simulation (blue line) on rectangular sample for Curvature angles 0^0, 45^0 and 90^0

Results

Tabel 1. The average values of elastic modulus obtained from calculation and direct measurement for sheet-shaped material (copy papper 100 gsm)

Angle	Sheet-shaped material (Copy paper 100 gsm)	Elasticity Modulus (Gpa)	
		Averaged Calculated	Averaged Measurement
0^0		2.42	1.4-2.1
45^0		2.18	1.4-2.1
90^0		2.32	1.4-2.1

Conclusion

We have shown video tracker & VBA for elasticity modulus measurement of sheet-shaped in material (copy paper 100 gsm).

This method a series of procedures:

- Tracking images using Video Tracker Software
- Calculating bending angles using cantilever beam equation
- These prosedures can be conducted at home

We can accurately estimate modulus material elasticity without tensile strength equipment.


Thank
YOU