Finite Element Analysis of a Unmanned Aerial Vehicle Deployment System

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Introduction

This study presents an innovative approach to the design and assembly of a UAV (Unmanned Aerial Vehicle) Deployment System constructed for vibration and frequency-based Structural Health Monitoring (SHM) applications. The centerpiece lies in the creation of a robust structure integrating a variable roller support system and a pinned support system for efficient UAV deployment. The design also incorporates a makeshift deployment shelf for UAV sensor packages.
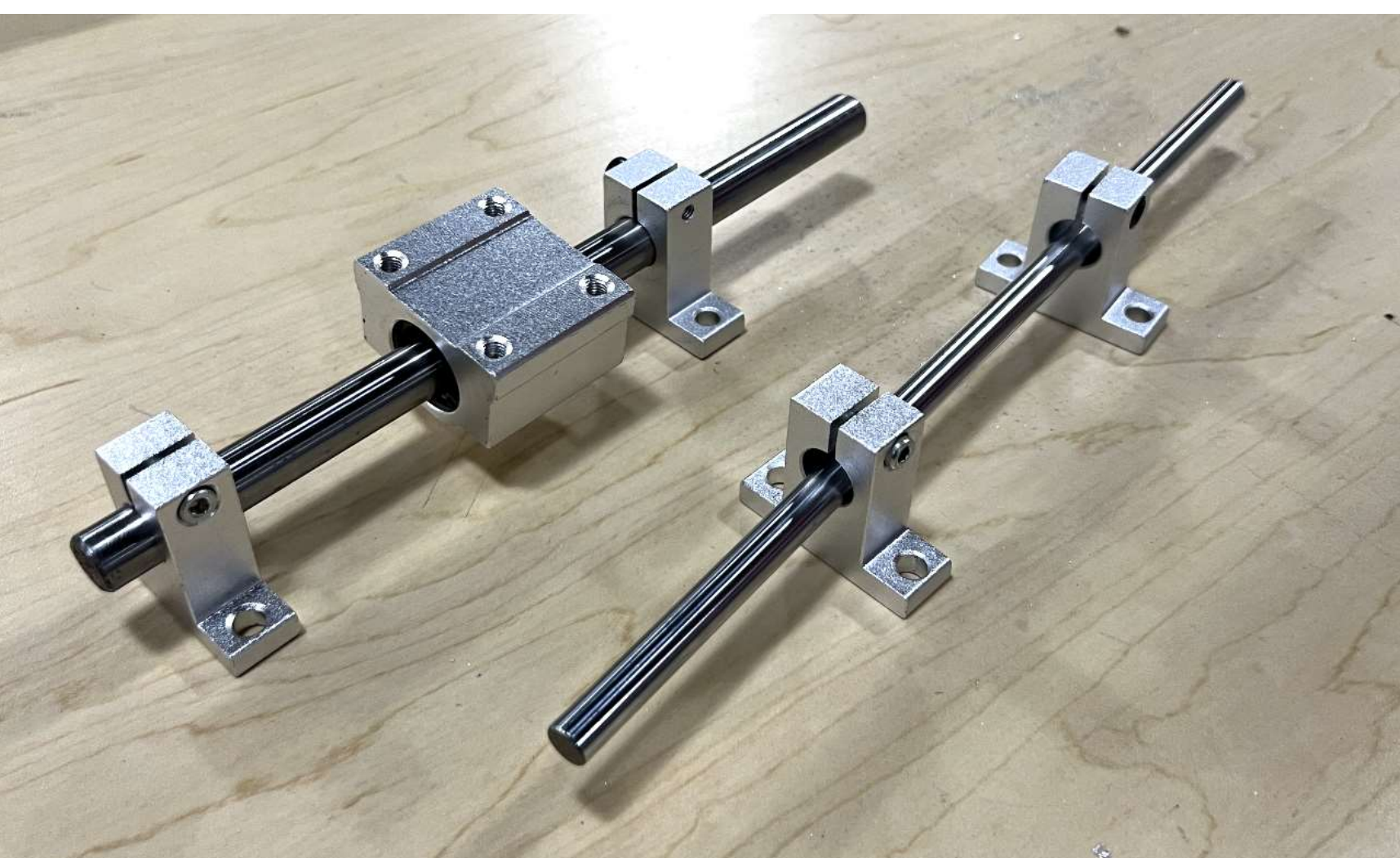

Methods

- **CAD Modeling (Fusion 360)**
- **Assembling**
- **Finite Element Analysis (FEA)** was conducted using Abaqus to affirm the structural integrity and performance of the proposed design under varying loads and other conditions. The FEA model of the beam includes:

1. Geometry Creation
2. Meshing
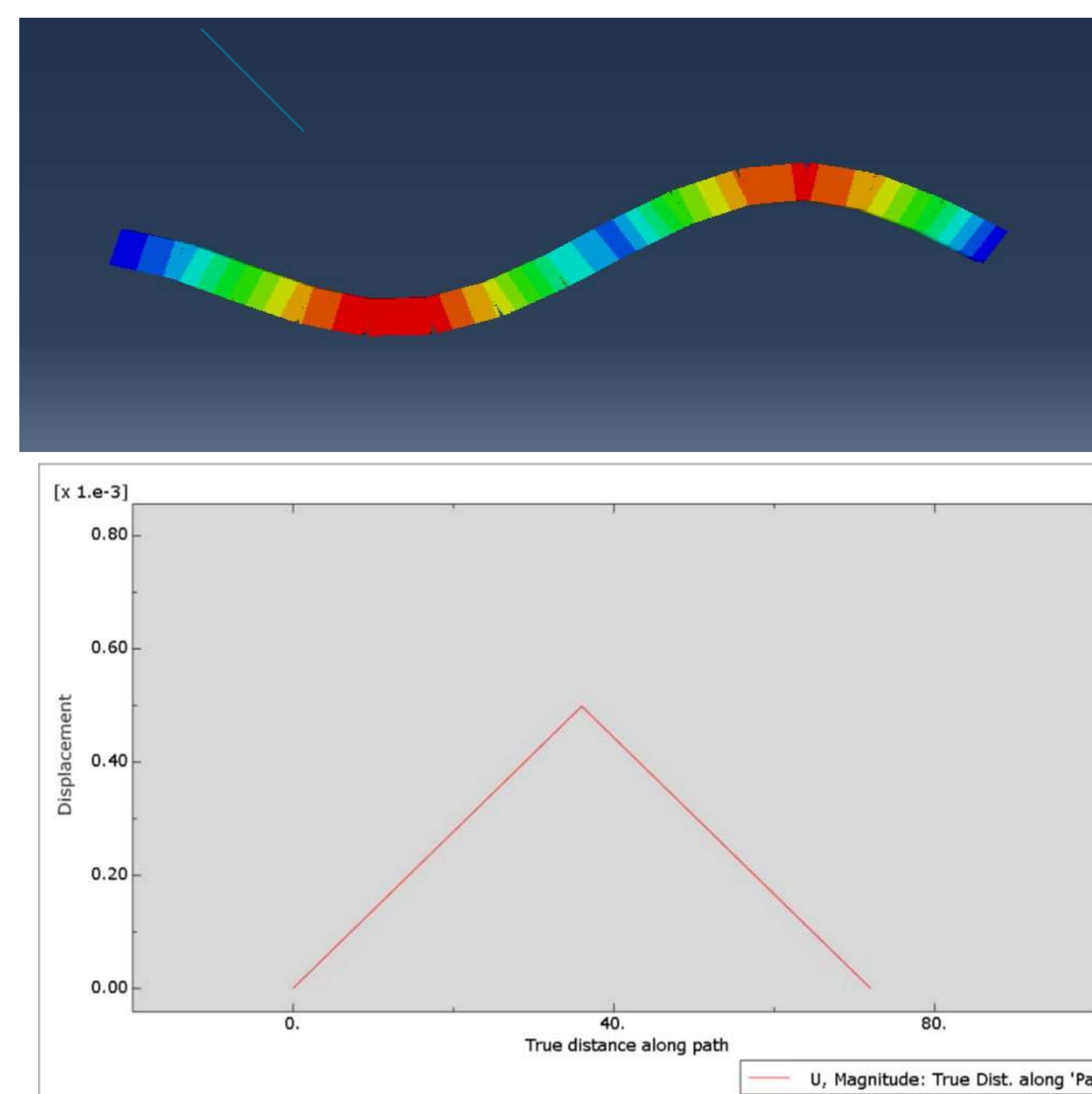3. Boundary Conditions
4. Loading Conditions
5. Material Properties

The analysis in Abaqus evaluated the beam's response, focusing on stress distribution, deformation, and natural frequencies.
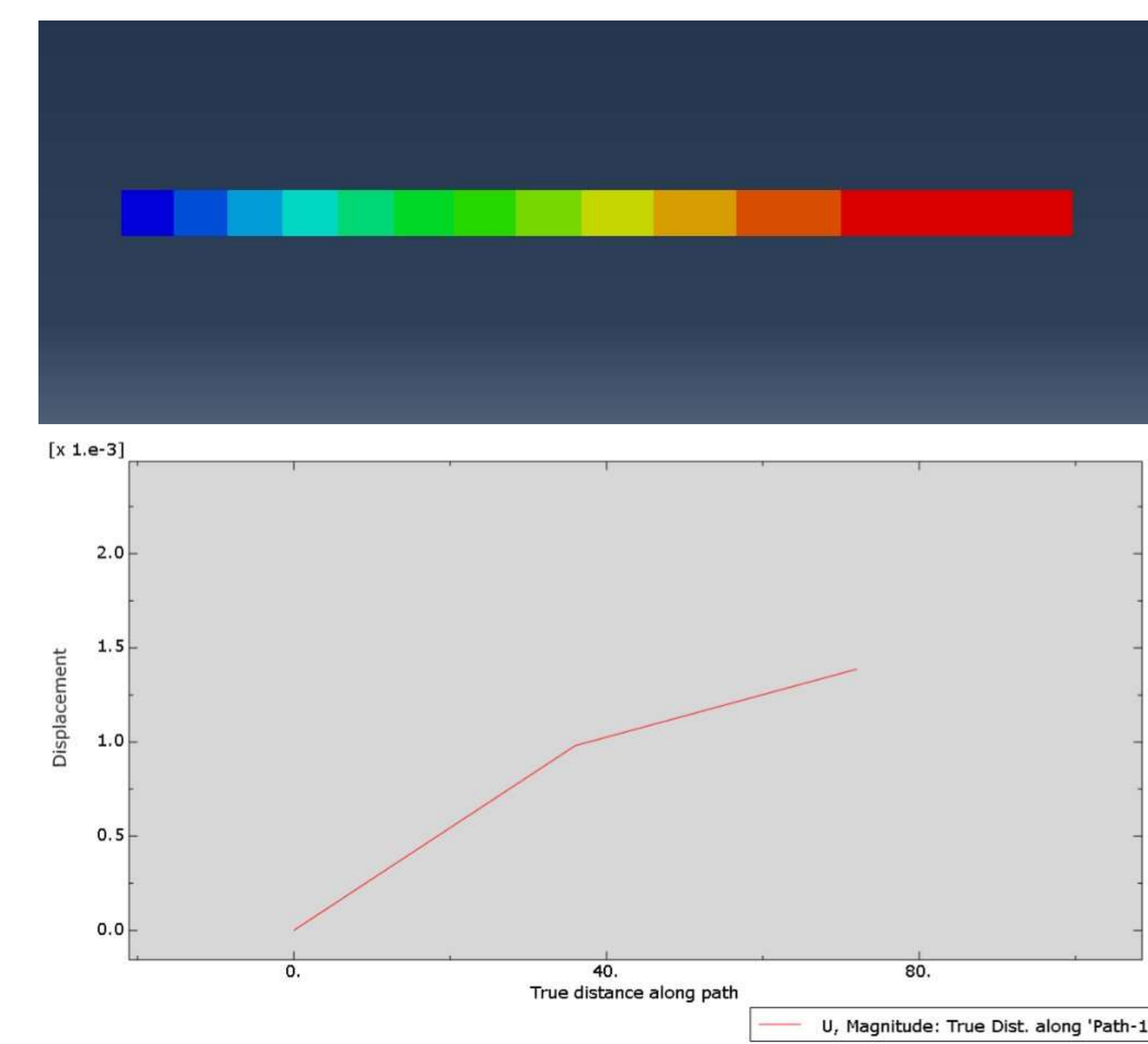
Results

Mode 1: 3.4 Hz

Pinned Support

Roller Support
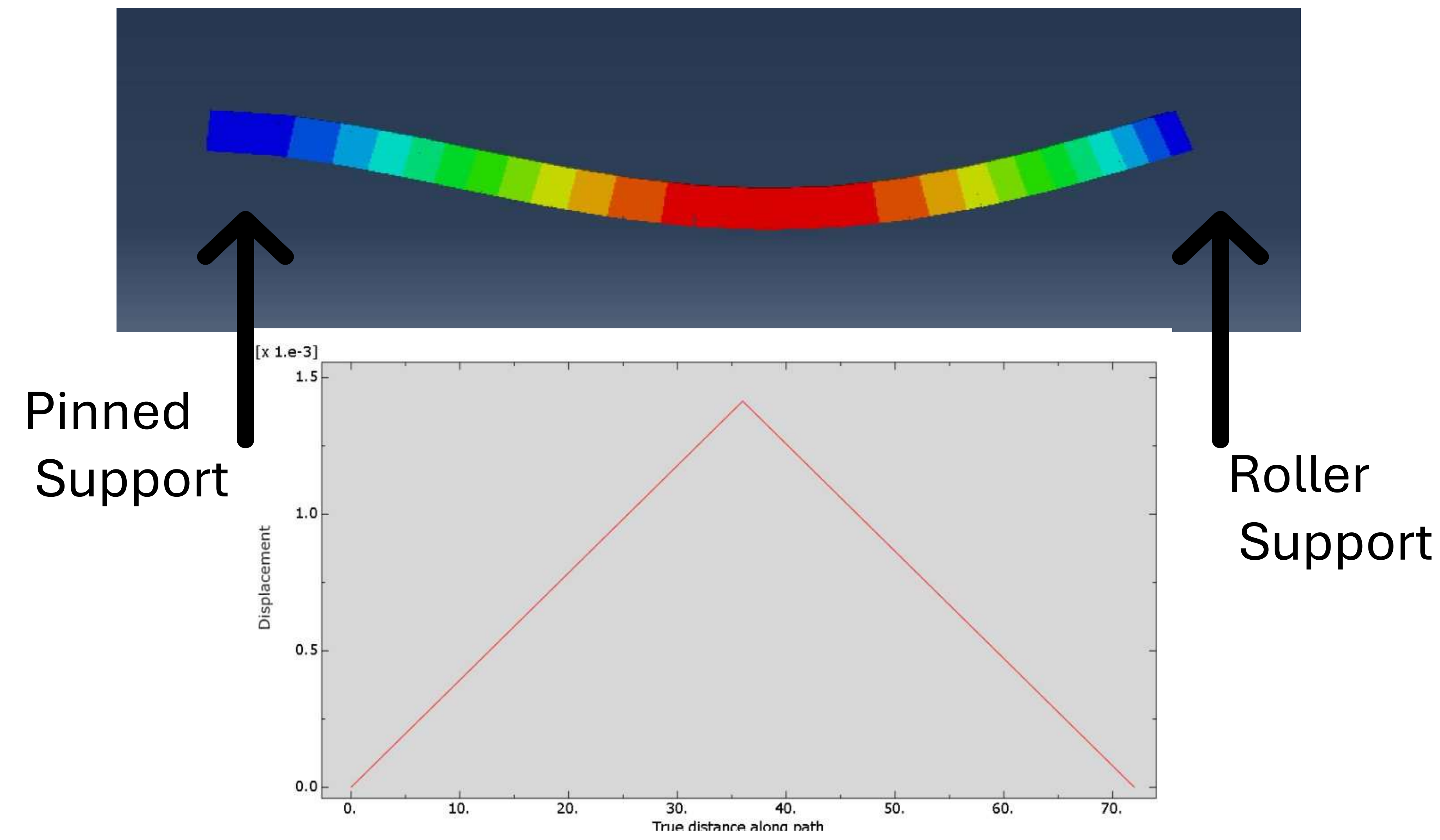
Mode 2: 10.5 Hz

Mode 3: 17.6 Hz

Conclusion

The FEA results show that the beam vibrates at three key frequencies: 3.4644 Hz, 10.586 Hz, and 17.687 Hz. To keep the beam stable during UAV operations, make sure the UAV's operational vibrations are not close to these frequencies. The next step is to tweak some of the input values, add final touches to the deployment system, and run tests with the UAV.