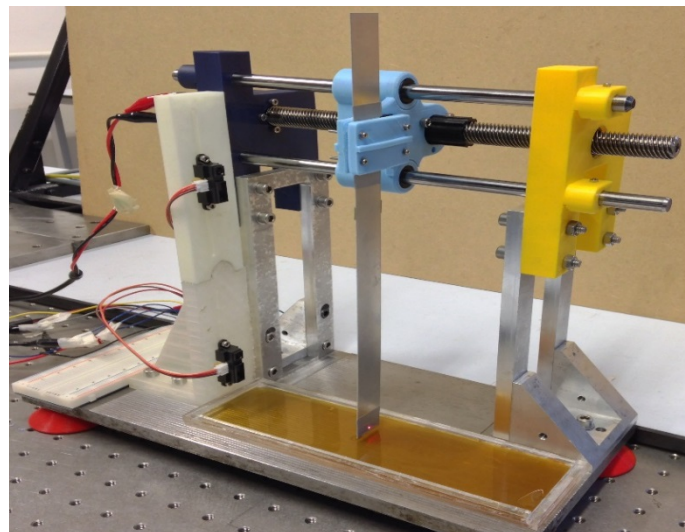


Introduction

The TDFM utilise a vertically mounted probe for obtaining the topology and mechanical properties of nano-scaled specimens. This technique represents a breakthrough in the field of microscopy. The aim of this project is to demonstrate the working principle of the TDFM with a scaled version of the actual model.

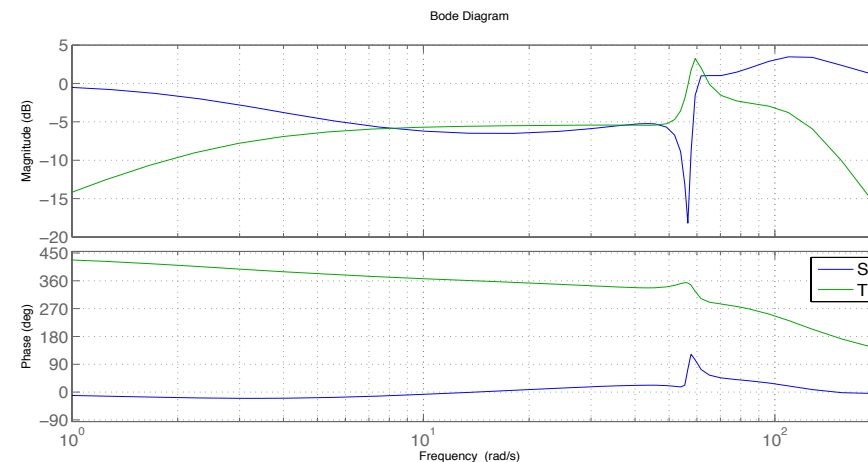
1. Features

The actuation system in the demonstrator is made up of a leadscrew and motor



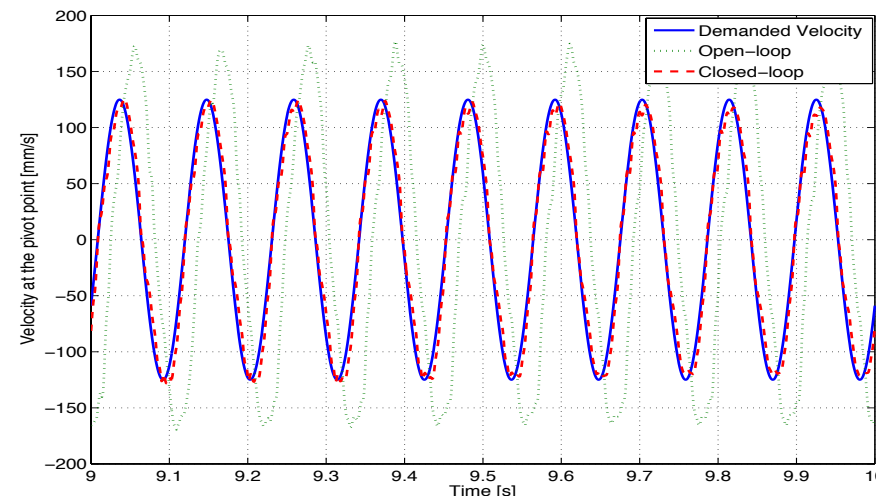
2. Frequency Shape Control

- Implemented to ensure stable oscillatory motion
- Optimised at cantilever beam resonance frequency at 56.55rad/s



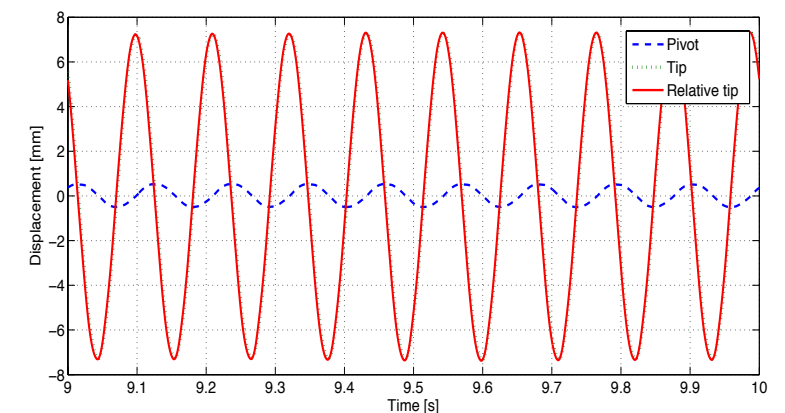
3. Control Performance

- Results show closed loop control matches the demand signal well



4. Shear Force Experiment

- Replicate the conditions of actual TDFM
- Carried out under open loop control due to limited equipment



Liquid	Depth (mm)	Deflection (mm)	Shear force (N)
Ambient	0	7.227	0
Water	3.5	5.009	1.76×10^{-8}
	7	2.241	3.95×10^{-8}
Motor oil	3.5	1.919	4.21×10^{-8}
	7	1.458	4.58×10^{-8}

5. Conclusion

The project has successfully developed a demonstrator that displays the operational characteristics of the actual TDFM model. This is only true for a short operating range of 5-20Hz. Beyond this range, non-linearity occurs due to mechanical limitations of the system.