

DESIGN AND DEVELOPMENT OF AN EXPERIMENTAL SETUP TO MEASURE BUCKLING / LATERAL VIBRATION OF DRILLSTRING IN OIL DRILLING OPERATION



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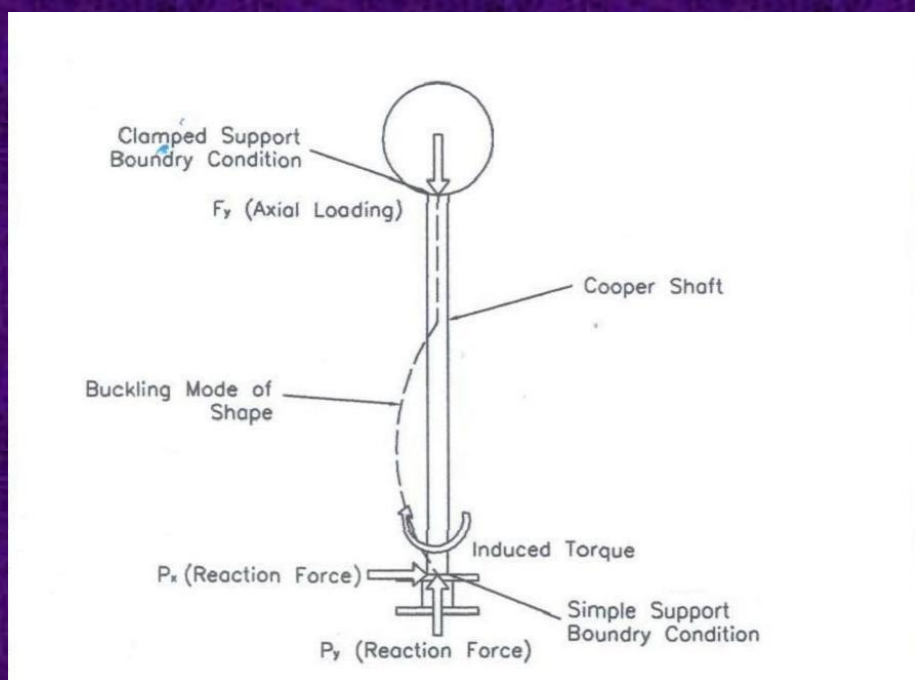
ABSTRACT

Drillstring vibrations are one of the causes of premature failure in drillstring drilling operation. The most vital vibration mode is lateral vibration. It causes two categories of failure; buckling of the drillstring and forward and backward whirl vibration. Downtime due to drillstring failure is a major source of drilling cost. In this study, an experimental set up has been designed and developed to simulate an oil drilling operation to appropriate scale. This experimental rig is used to measure the buckling and lateral vibrations. A DC motor is used as the prime mover to rotate a shaft (hollow slender copper rod), which represents a drillstring. The motor rotated the shaft onto a hard surface and axial loading are introduced to the shaft. The behavior of the shaft is recorded by using Laser Doppler Vibrometer (LDV) and the digital processed signals are computationally recorded. The result from experiment can be analyzed by focusing on deflection mode of the shaft under axial loading and unconfined rotation motion.

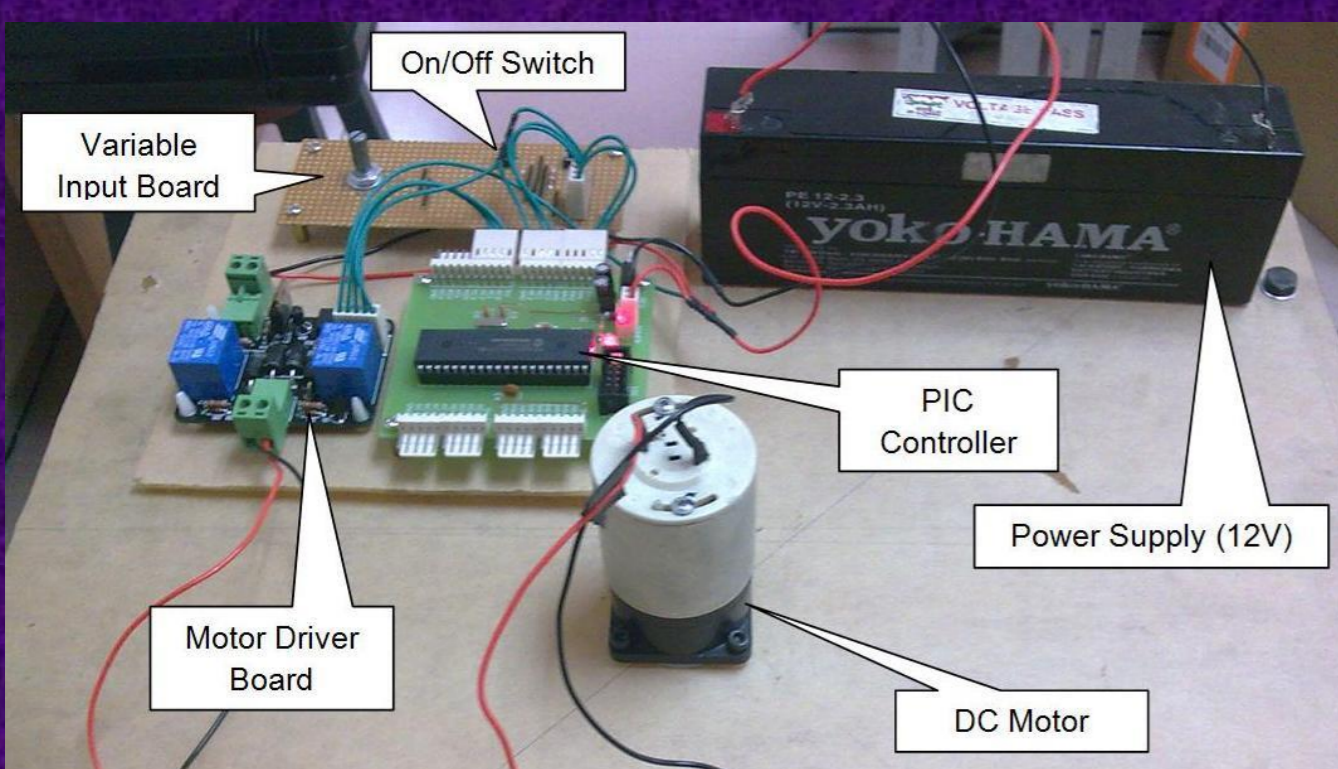
OBJECTIVE

Main objective of this study is to design and develop an experimental set up to measure the buckling and lateral vibration of drill string in oil drilling operation.

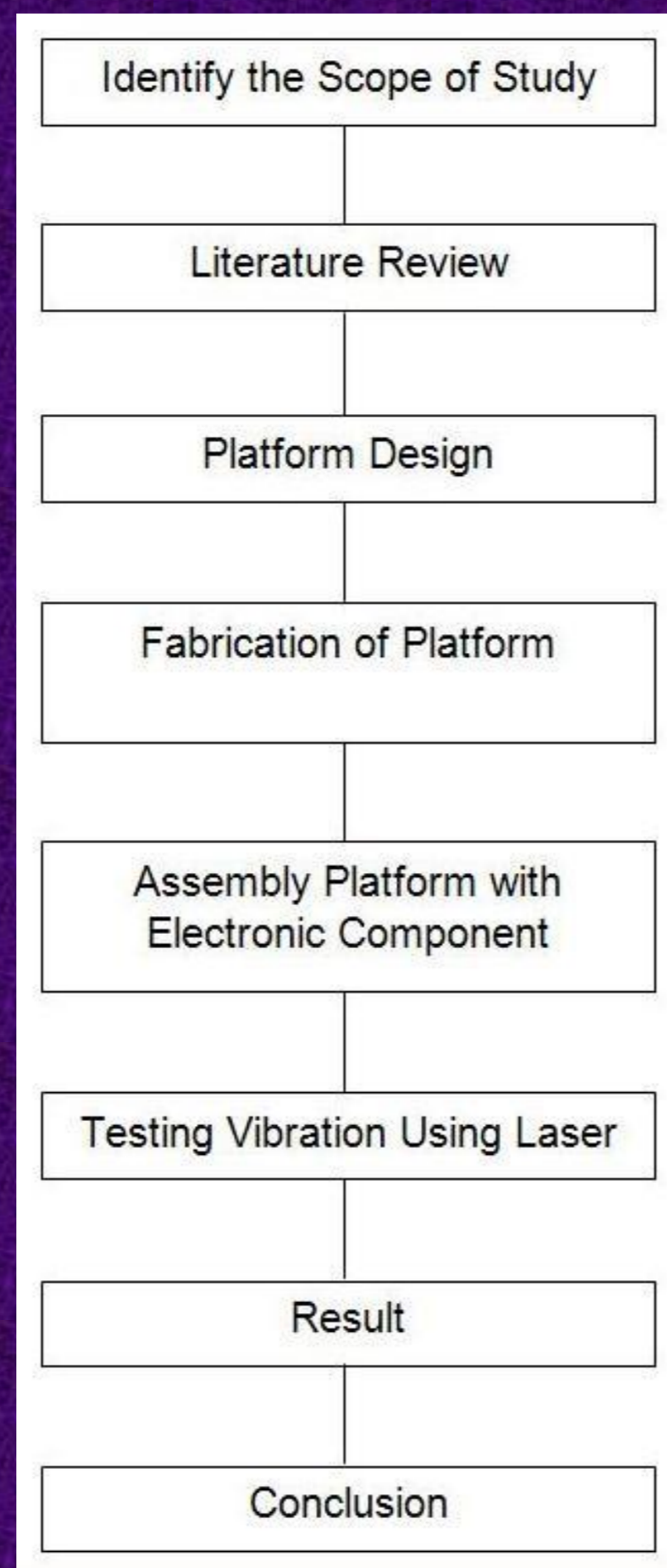
SIMPLIFIED VERSION OF DRILLSTRING



ELECTRONIC COMPONENTS

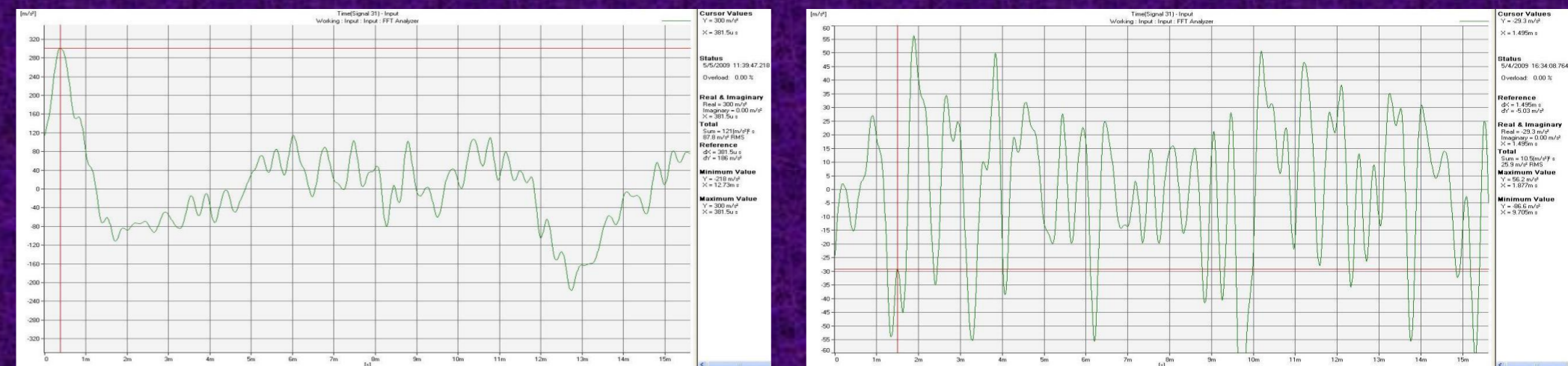


METHODOLOGY

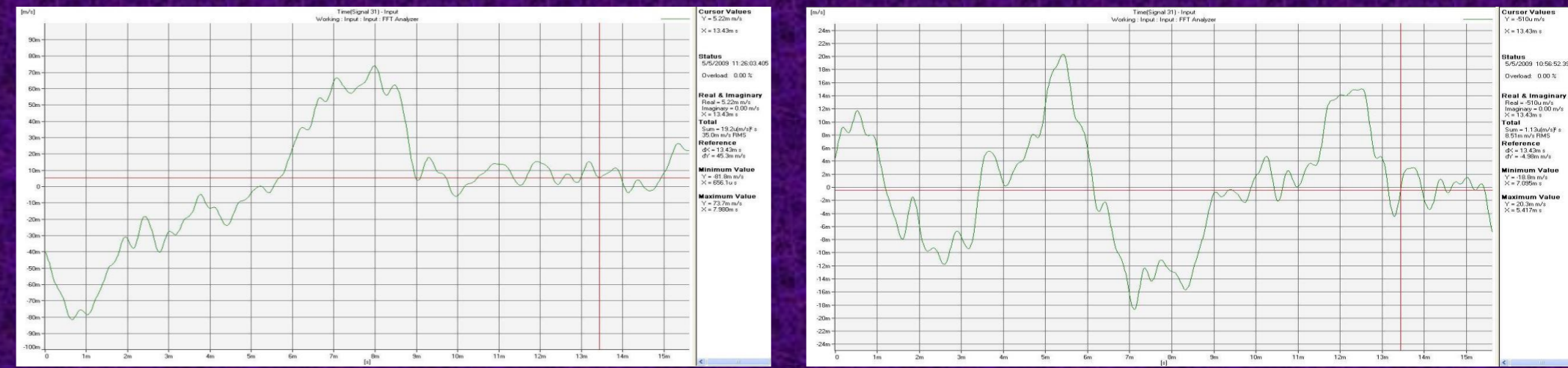


RESULT

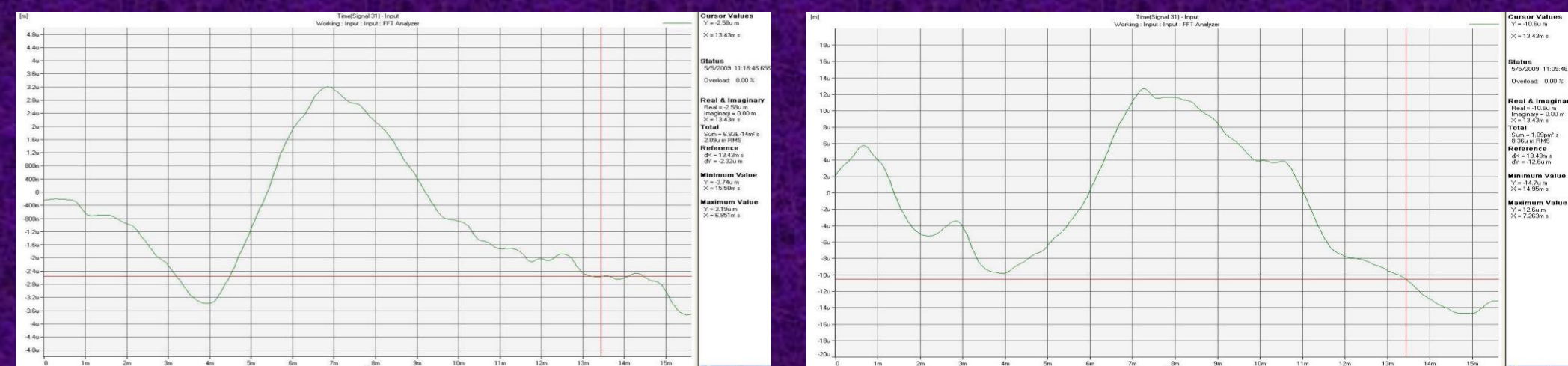
Graph Acceleration (m/s²) against Time(s)



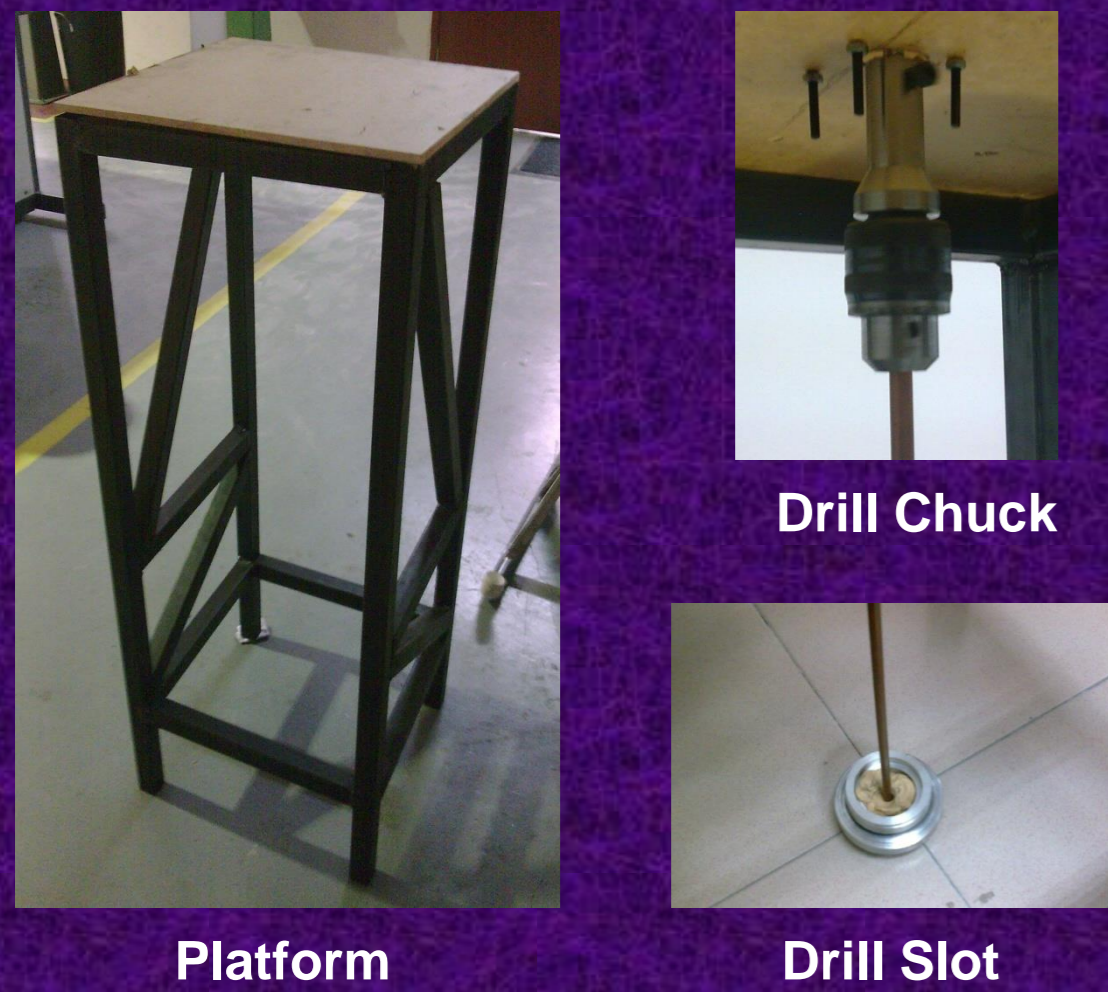
Graph Velocity (m/s) against Time(s)



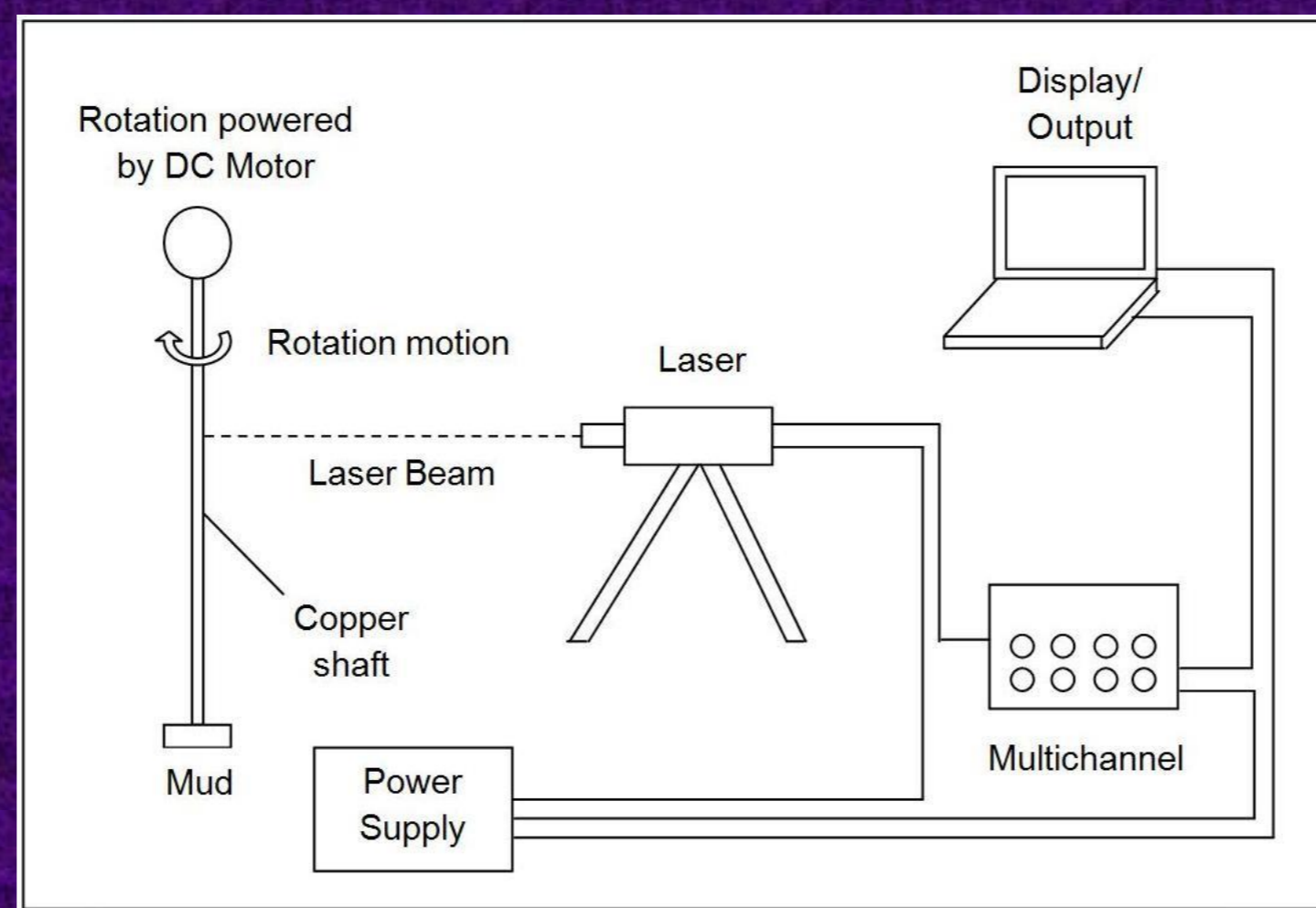
Graph Displacement (m) against Time(s)



MECHANICAL PART



EXPERIMENTAL SETUP



Schematic Diagram of Experimental Setup

CONCLUSION

The experimental rig set up has been successfully designed, modeled and developed. The behavior of rotational shaft vibration was recorded and measured using Laser Doppler Vibrometer. The rotation of the drilled is measured using a photo-tachometer.

RECOMMENDATION

Although an extensive study on the subject has been conducted, some further developments of interest are necessary and as follows:

1. The experiment conducted is subjected to a simple rod which represents the drillstring. For future analysis, it is recommended that simulated drillcollar and drillbit using force vibration is carried out.
2. In this experiment, the rotation of the drilled is measured using a photo-tachometer. For future analysis, it is recommended that the rotation of the drilled should be measured using a latest model of tachometer.

LASER DOPPLER VIBROMETER EQUIPMENT

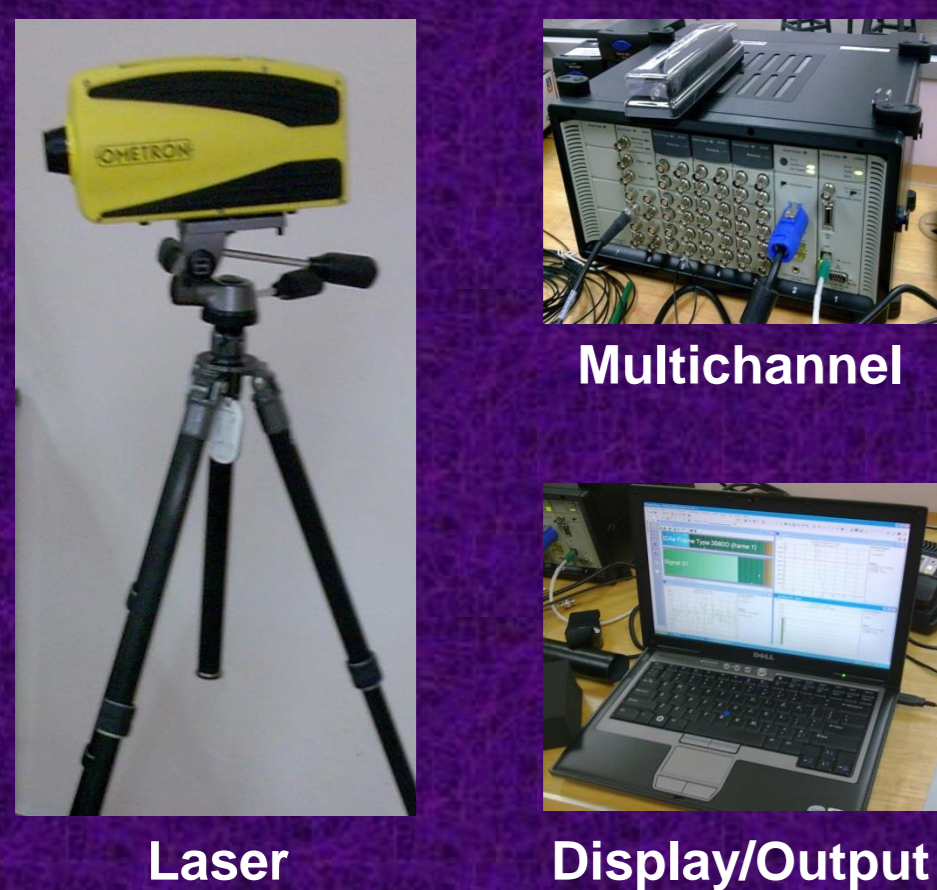


Photo of Experimental Setup