

Gantry Crane

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Abstract

This project is about designing and building a Gantry Crane that can lift the Electromagnetic Shaker and hold it in a specific position while the machine is being used for Hand-Arm Vibration (HAV) tests.

The crane will have to lift the machine off of the concrete base, move it to a desired location and orient it in a desired position.

The gantry crane will make the operation of moving the heavy machine easier and safer for the operator.

Introduction

Main Functionalities:

- The Gantry Crane has maximum lifting capacity of 907kg (2000 lbs).
- The crane will have an adjustable height feature which will allow the operator to set the machine at a desired height and store it in small space when it not being used.
- The crane will be able to move with a manual push or pull.



Figure 1: Structure of the Gantry Crane

Methods and Materials

The size of the crane was determined by measuring (in centimeters) the surroundings of the area where the machine is kept in the lab.

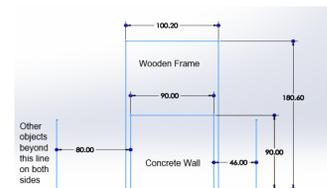


Figure 2: Measurements of the surroundings in the lab

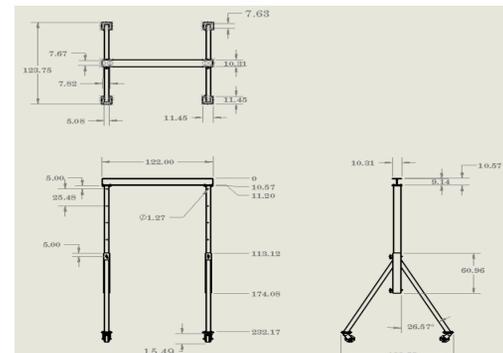


Figure 3: Dimensions of the Gantry Crane

The material of the crane is decided by considering the maximum lifting capacity, safety of the operator, and budget of the project.

The material selected for this crane is Steel. The material of the I-beam is ASTM A992/A572-50 and the material of the rectangular tubes are of grade ASTM A500.

A sliding mechanism is designed for the adjustable height feature. This mechanism will allow the vertical beam to slide up and down through middle support beam and the pins will be inserted through the lined-up holes of both beams to lock the height of the crane.

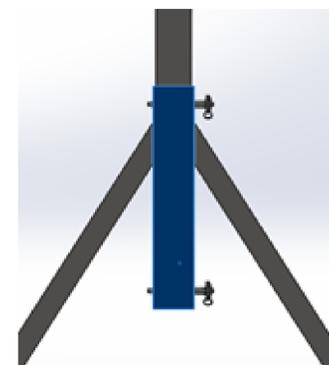


Figure 4: Adjustable Height Mechanism

Results and Discussion

Results	Minimum	Maximum	Units
Equivalent Stress	0.	1.2767e+008	Pa
Maximum Principal Stress	-1.1401e+007	1.3684e+008	Pa
Shear Stress	-5.5741e+006	5.2496e+006	Pa
Total Deformation	0.	3.7638e-004	m
Normal Stress	-2.8398e+007	3.7157e+007	Pa

Figure 5: Result Summary from ANSYS

The analysis was performed by sectioning the crane vertically in half and applying 2224N (500lbf) of force to the crane. The Factor of Safety of 3.023 is calculated using the results from analysis.

Conclusions

The gantry crane built for this project will allow the lab operator to lift the Electromagnetic shaker and orient it in horizontal and overhead position. Also, it will allow the operator to change height of the gantry crane. Overall, this crane will make the task of moving the heavy machine easier and safer.

Acknowledgements

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