

Device For High Strain Rate Deformation Research And Experiments

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Abstract

The task of this project is designing a suitable fixture for the Split-Hopkinson bar device in NIU's lab. The fixture is used to mount the air bearing that is used to support the incident bar and transmit bar. Figure 1 shows the schematic of Split-Hopkinson bar.

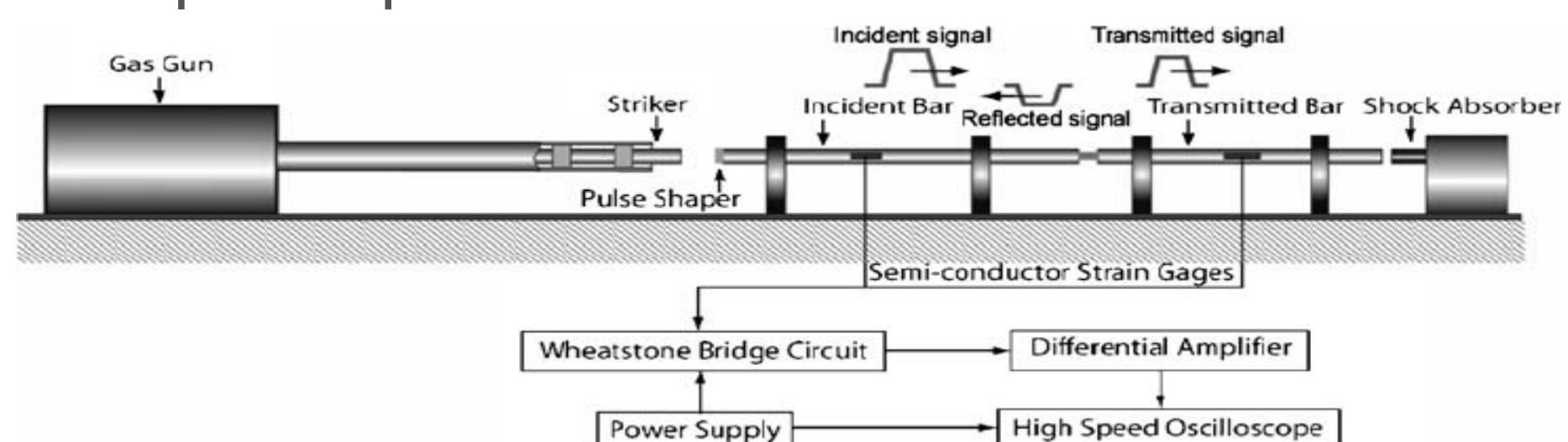


Figure 1:The schematic of Split-Hopkinson bar

Introduction

This project is an improved design; the Split-Hopkinson bar apparatus exists many years in EB143 Lab in NIU. It has been redesigned and improved by many classmates. Now, the high strain rate compression experiment was successful, we committed to finishing the high strain rate tensile experiment. For getting the faster impact speed, the project used half inch bar rather than 1 inch and air bearing which can produce less friction than linear bearing. The air bearing is aerostatic, so the high-pressure air is provided by air pump.

Methods and Materials

The method to control the Z-displacement is using four screws whose unthread parts are mounted in four ball bearing, in this way, when rotating the screws, the screws will go up linearly, just like jack. The method to control the Y-displacement is using four slots, the air bearing can be moved slightly in Y-direction, but it is enough.

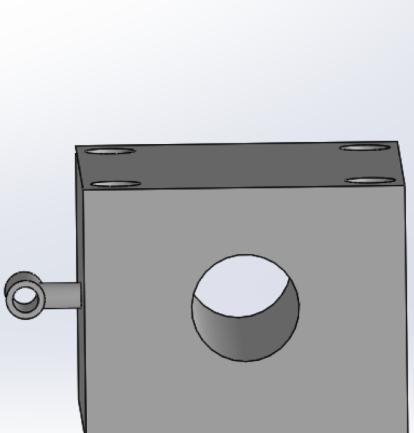


Figure 2: The model of air bearing

Results

In this semester, the fixture was redesigned and molded. Figure 3 shows the model of fixture.

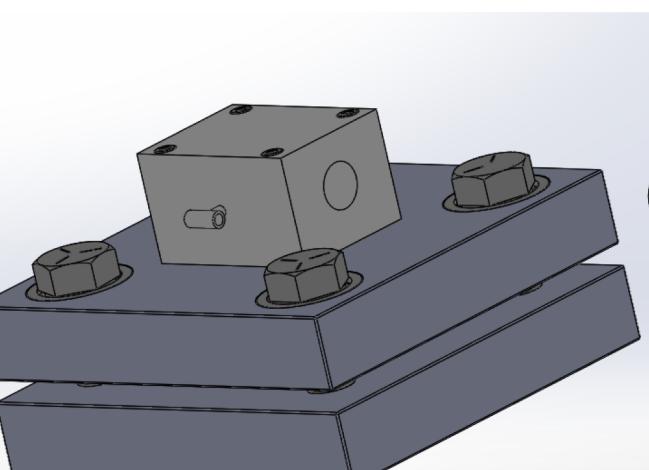


Figure 3:The model of fixture

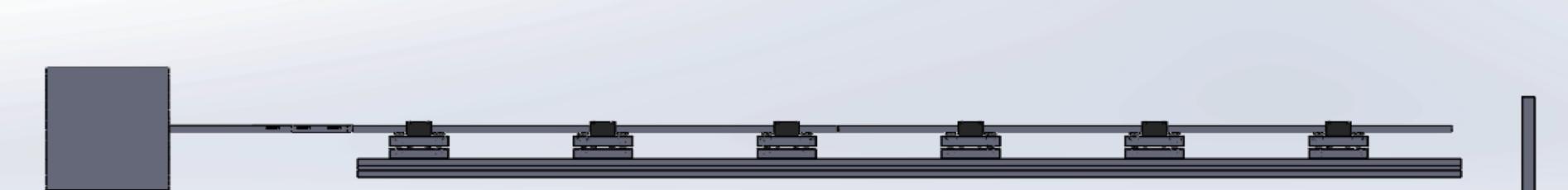


Figure 4: the model of Split-Hopkinson device

Discussion

The cost of this fixture is huge. It takes 1000 dollars. The assemble procedure is complicated, it needs sleeve bearing and skills of assembler. The ball bearings are not sealed, so they are need be lubricated on time.

Conclusions

In SolidWorks, the extra freedoms of motion are restricted. Then we can simulate the motion of screws, bearings and bolts. It shows that the fixture can mount the air bearing suitably and accurately. In ANSYS, the contact condition and boundary condition are set, then deformation of fixture is calculated out. The maximum deformation is $2.3e-6$ millimeters.

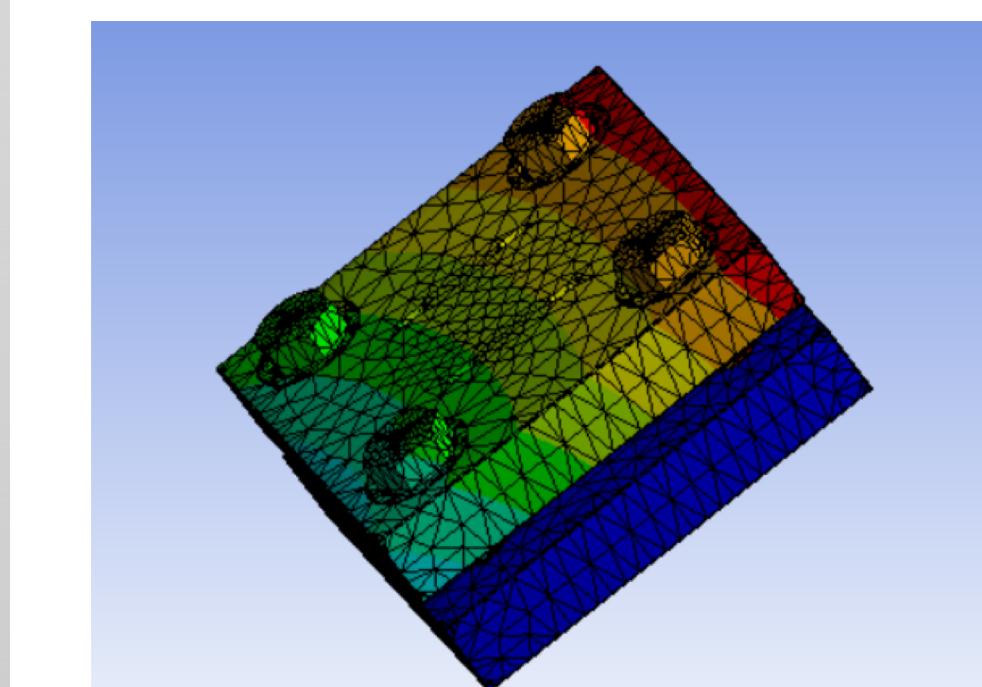


Figure 5: The calculated deformation of fixture

Acknowledgements

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