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RESEARCH ABSTRACT FORM

TITLE: High Rate Testing: What is all the "Noise" about?

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Problem:

It is a proven fact that many materials exhibit different behaviors in quasi-static testing, as compared to high strain-rate testing. Engineers and research scientist of today face increasing pressure from industry to compile data for various materials in high strain-rate testing. This is because of the increasing use of Finite Element software and computer simulations. However, the biggest obstacle that is encountered while producing this data is noise induced by the stress waves that are reflected during high rate testing.

The difficulties that face researches in this field are the lack of published data. Currently there are few, if any guidelines that explain high rate testing. This poses problems because results cannot be repeated in another lab if the lab does not know their testing procedure. Currently organizations such as, The University of Dayton Research Institute, The Society of Automotive Engineers, and The American Society for Testing and Materials are working to help standardize and publish testing guidelines.

A specific problem that will be addressed in this research study is how to deal with noise induced by stress waves. Stress waves typically do not create a problem during low rate, quasi-static testing. During high rate testing however, as loads are applied to parts, a stress wave then travels through it. As a result the reflected wave is observed rather than the data you intend to collect.

Approach:

For the control, twelve tensile test specimens will be tested in a quasistatic environment. Six shall be E8 Subsized, and the remaining six will be D638 Type 5. A detail of the test matrix will be attached to the poster.

Results:

Material behavior changes between the two types of testing. The ultimate yield strength and the toughness of the steel changed. During high rate testing, you could not positively determine the exact point of failure of a material due to the propagation of stress waves.

Conclusion:

My hypothesis proves correct that material behavior changes depending on the strain rate being tested. Typically mild steel will absorb more energy and have a higher ultimate tensile strength as the strain rate increases. It is also possible to obtain comprehendible data using statistics, trend lines, and comparing the material to quasistatic test behaviors.