Check for updates

Proceedings of the 9th Biennial ASME Conference on Engineering Systems Design and Analysis
ESDA2008
July 7-9, 2008, Haifa, Israel

ESDA2008-59198

Full Field Strain Measurement in Split Hopkinson Bar Experiments

Amos Gilat[1], Tim Schmidt[2], John Tyson[2], and Andrew Walker[1]

[1]The Ohio State University
Department of Mechanical Engineering
Columbus, Ohio, 43210, U.S.A
Gilat.1@osu.edu (correspondent author)

[2]Trilion Quality Systems
West Conshohocken
Pennsylvania, U.S.A

A method for full field measurement of strain (and strain rate) in split Hopkinson bar experiments (compression, tensile, and shear) is introduced. The measurements are done by using the Aramis three-dimensional image correlation system. The system uses two digital high-speed cameras that provide a synchronized stereo view of the specimen. Depending on the number of pixels used, the system is capable or recording frames at a rate of up to about 110,000 per second. Before conducting a test, a random dot pattern is applied to the surface of the specimen. The image correlation algorithm uses the dot pattern to define a field of overlapping virtual gage boxes. The 3-D coordinates of the center of each gage box is determined at each frame, interpolated to better than 1/100 of a pixel. The coordinates are then used for calculating the deformations, strains, and strain rates throughout the surface of the specimen.

The Aramis system is used to study the response of OFHC copper and 2024 aluminum. In addition to measuring the strain with the Aramis system, the strains are also measured with a strain gage that is placed on the gage section. The strains are also determined from analyzing the elastic waves in the bars. The results show the complete strain field during the tests, including details of the strain field when necking develops in tensile tests prior to the failure. In tension and compression the strains from the Aramis system agree with the average strain that is measured with the strain gage. In compression and shear the strain calculated from the elastic waves agree with the strains from the Aramis system, but in tension the agreement depends on the geometry and properties of the specimen.

Downloaded from https://asmedigitalcollection.asme.org/ESDA/proceedings-pdf/ESDA2008/48357/561/2710902/561_1.pdf by guest on 17 October 2019

Copyright © 2008 by ASME