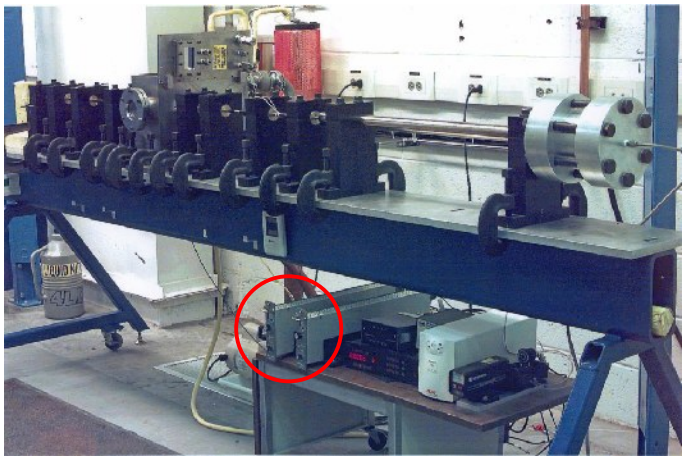
9/09

ECTRON'S MODEL 778 AND THE SPLIT HOPKINSON BAR

If you haven't heard of the Split Hopkinson Bar raise your hand. You are not alone. This note will enlighten you. There is an important association between the SHB and the Model 778. Why? Primarily because frequently the SHB needs a very wideband dc conditioner-amplifier and Ectron has the only one with the right specs.

What is an SHB used for?

When materials are subjected to high stress rates, they react differently than when tested under static conditions. This difference changes depending on the rate of applied stress, temperature, and other factors. An example is a golf ball! When hit by a golf club the outside cover deforms which launches the ball on its flight. Under static tests this cover behaves differently than when whacked by the club especially when the golfer is Tiger Woods. So, current ball covers are tested using Hopkinson bar techniques to determine just what happens to the cover when hit and to find out what type of cover gives the ball the greatest distance, or whatever characteristics are desired.



Split Hopkinson Bar Showing Two Ectron Model 778 Conditioner-Amplifiers

Obviously, one of the biggest applications is in the area of weaponry. Projectiles and the armor they hit must all be studied to determine their characteristics under these high stress rate conditions.

What is an SHB?

Usually this device consists of a cylindrical metal rod several feet long and from less than an inch to several inches in diameter. The bar is split into two or three pieces and the specimen is placed between two of the pieces. One end is driven into the other by compressed air or an explosive device. The important information is how hard the bar hits the specimen and what the stress wave shape is. This is determined by placing strain gages in several places along the bars.

Usually megahertz frequencies are involved, which is where the Ectron Model 778 comes in. With from two to four strain gages in use and simultaneous data required, the user needs two to four or more Model 778 amplifiers. If the desired data are lower in frequency then the Ectron Model 753A or even the Model 563H may be acceptable.

Model 778 Development

Originally developed for one of the national laboratories, the Ectron Model 778 Conditioner-Amplifier has several unique characteristics that make it the best choice for use with the SHB: dc to 3 MHz bandwidth, conditioning for strain gages, the highest high frequency common-mode rejection of any commercially available dc amplifier, and dual output signals with one precisely matching a 50 Ω coax cable.

Important Model 778 specifications for this application:

Response
Dc to 3 MHz

Rise Time
150 ns for a full-scale step (10% to 90%)

Common-Mode Rejection
>120 dB, dc to 100 kHz
>80 dB, dc to 5 MHz

Switched Filter
Steps of 10 Hz, 100 Hz, 1 kHz, 10 kHz, 100 kHz, and 300 kHz, plus a wideband position, 4th order Bessel

The SHB is frequently just called the Hopkinson Bar but is also called the High Strain-Rate Split Hopkinson Bar. John Hopkinson did preliminary work on the dynamics of metals in 1872 and his son Bertram actually used a two-bar machine in 1914. The split Hopkinson (three pieces) was devised by Kolsky in 1949.

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