

DEVELOPMENT OF A LASER DISPLACEMENT SENSOR SYSTEM

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BACKGROUND

OBJECTIVES

- STUDY THE ENHANCED LASER VELOCITY SYSTEM (ELVS) DEVELOPED BY CONVERGENT MANUFACTURING TECHNOLOGIES
- DEVELOP A SIMILAR LASER DISPLACEMENT SENSOR SYSTEM AT UD-CCM

OUTLINE

- THE ELVS SYSTEM
- COMPONENTS
- WORKING PRINCIPLE
- FABRICATION OF THE LASER DISPLACEMENT SENSOR SYSTEM (LDSS)
- APPLICATIONS

WHAT IS IT?

- ♦ A new form of measurement of a projectile's motion during ballistic impact



- Able to track small, light projectiles without contact
- Cost-effective, accurate, and easy to use

COMPONENTS OF THE SYSTEM

RS Laser Diode Module

Producer:
Power Technologies Inc.



Specifications

- ♦ Line Generating Optics
- ♦ Wavelength of 670nm
- ♦ Power Output between .75 - .95 mW
- ♦ Class Type II
- considered as eye safe
- ♦ Operates at a voltage of 3 - 9 Volts

Key features of laser:

- ♦ Quasi-Collimating Optics
- ♦ Complete Single Encapsulated Unit
- ♦ Constant Optical Power Output

COMPONENTS OF THE SYSTEM

The system includes four lenses

- Cylindrical Lens 1**
 - 50mm x 60mm x 100mm focal length
 - Used to collimate laser
- Neutral Density Filter**
 - 50mm square absorptive filter
 - Used to filter out loose particles from laser
- Cylindrical Lens 2**
 - 15mm x 60mm x 25mm focal length
 - Continue collimation of laser
- Collector Lens**
 - 50 mm diameter
 - Used to collect the collimated laser plane and have it converge into a point onto the photo detector



COMPONENTS OF THE SYSTEM



Key Features

- Must be applied as a Reverse Bias Circuit applied to reverse bias creates a photoconductive mode generates
 - higher speed in response
 - lower capacitance
 - better linearity
- High pulse response detection

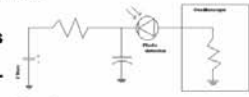
PHOTO-DETECTOR

Producer:

Edmund Optics

Specifications

- Silicon PIN photo-detector
- Area of Detection: 15mm²
- Rise time of 2ns
- Bandwidth sensitivity up to 50 MHz



COMPONENTS OF THE SYSTEM

Setup of LDSS System

- ♦ Power Supply connected to the laser diode, and to the reverse bias of photo-detector circuit

- Voltage meter or data acquisition card is connected to the circuit of the photo-detector

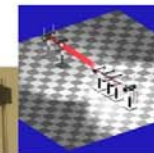


Once Turned on, LDSS laser diode generates a line laser. The line is then collimated after it passes through the first cylindrical lens creating a planar laser. The planar laser then passes through the rest of the lenses until it reaches the collector lens, which then makes the planar laser converge to one point that strikes the photo-detector

ADVANTAGES

LDSS is a powerful new tool that allows:

- ♦ An accurate measurement of displacement as a function of time of a moving object
- ♦ Provides measurement without any contact
- ♦ Cost-effective, reliable, and easy to use
- ♦ Components cost 10% of commercial system
- ♦ Applications
Ballistic Impact
Hopkinson Bar



FUTURE WORK

- ♦ Proper calibration to the LDSS system
- ♦ Additional circuitry to amplify voltage coming out of the photo-detector circuit
- ♦ Create a lab view program for data acquisition card
- ♦ Begin experimentation to provide displacement data

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