

Strain Gauge

Elementrix Classes

Introduction

- ❑ A strain gauge is a type of transducer used to measure mechanical strain or deformation in a material. It operates on the principle that the electrical resistance of certain materials changes when subjected to mechanical strain. Strain gauges are widely used in engineering, structural analysis, materials testing, and industrial applications to monitor and measure stress, load, and deformation in various structures and components.

Strain Gauge

Direction of strain

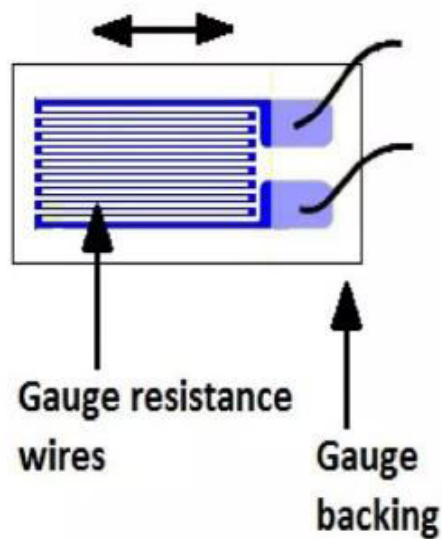


Figure #1

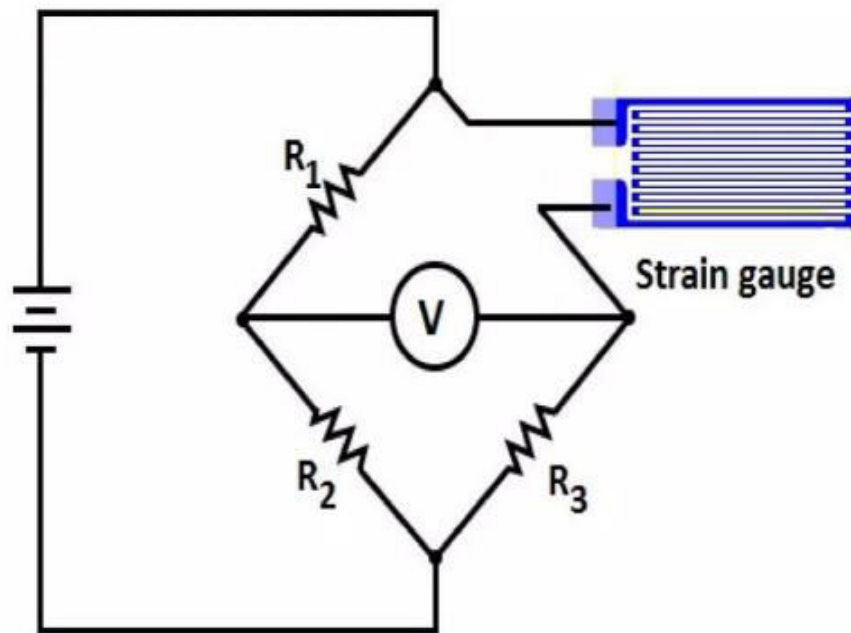


Figure #2

Working Principle

- ❑ Strain gauges are typically thin wires or foil patterns made of materials such as constantan or nickel-chromium alloy (known as "gauges") bonded to a flexible backing material.
- ❑ When the material to which the strain gauge is attached experiences mechanical strain (such as tension, compression, bending, or torsion), the gauge undergoes a corresponding change in length or shape.

- ❑ This change in length or shape results in a proportional change in the electrical resistance of the strain gauge, according to the material's strain gauge factor.
- ❑ By measuring the change in resistance of the strain gauge, it is possible to determine the amount of strain experienced by the material.

Configuration

- ❑ Strain gauges are typically arranged in a Wheatstone bridge configuration, along with precision resistors, to measure the small changes in resistance accurately.
- ❑ The Wheatstone bridge setup allows for the detection of small changes in resistance due to strain by comparing the voltages across different branches of the bridge.

Installation

- ❑ Strain gauges are bonded to the surface of the material under test using an adhesive or epoxy resin.
- ❑ The material to which the strain gauge is attached is known as the "substrate" or "test specimen," and it can be made of metal, composite, or other materials.
- ❑ Careful installation and calibration are essential to ensure accurate measurements.

Applications

- ❑ Strain gauges are used in a wide range of applications, including structural health monitoring of buildings, bridges, dams, and pipelines; aerospace and automotive testing; load cells and force sensors; material testing in laboratories; and process monitoring in manufacturing industries.
- ❑ They provide valuable data for evaluating the performance, safety, and reliability of structures, components, and materials under various operating conditions.

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