SILICON STRAIN GAUGE TRANSDUCER INSTRUMENTATION FOR INDUSTRIAL, MEDICAL, ENGINEERING AND SCIENTIFIC APPLICATIONS

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PREFACE

This thesis comprises an account of applications made by the author of silicon strain gauge instrumentation. The applications are in various fields like Industrial, Medical, Engineering and Scientific.

While some of the work may be of developmental nature, i.e. obtaining strain gauge applications matured abroad but not yet in this country, the others are new. It is the author's hope that the methodology used in the present investigations helps open out a large number of the other new applications in diverse fields not touched upon in the present work. Most of these applications, like those reported, would depend upon the fact that a convenient and practical procedure makes possible monitoring and measurement of very small displacements.

The thesis has been divided into six sections, each section being further divided into chapters.

Section I incorporates introduction of earlier work on transducer-instrumentation, introduction of semiconductors (silicon and germanium) for strain gauge transducers, strain gauge material, their characteristics, bridge circuits, temperature compensation techniques, gauge fabrication and installation techniques.

Section II describes the measuring apparatus and experimental techniques used by the author.

In Section III are given Industrial transducers for the measurement of pressure (high pressure as well as vacuum), column heights, depths, flow, level and weight (small and big).

Section IV deals with various medical transducers for physiological measurements like intra-arterial blood pressure, thoracic pressure, pulse and breathing rates. A new medical investigation has been reported showing that almost all exterior body parts execute small rhythmic movements in step with respiration.

Section V describes the Engineering and Scientific applications like voltage measurement, effect of magnetic field on gauge sensitivity, effect of temperature on this increased sensitivity, effect of electric field on gauge sensitivity, measurement of piezoelectric strain of quartz, testing of goodness of these crystals, measurement of electro-striction and magneto-striction of all ferromagnetic and non-ferromagnetic materials and also electrostriction of materials placed in a magnetic field.

Section VI incorporates an increased temperature compensation technique using carbon resistors and also some methods of temperature measurement.

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