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## テクニカル レポート

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### 坂田式三成分ひずみ計の基礎

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### Basic Theory of Sakata-type Three-component Strainmeter

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#### Abstract

The Sakata-type three-component strainmeter, invented and developed by the author, is expected to serve as a long-period strain seismograph as well as a research tool for short-term earthquake prediction, since detection of co-seismic strain steps has confirmed a quantitative reliability of the instrument as a three-component borehole strainmeter.

The strainmeter measures the change in area of three separate chambers composing the underground sensing part. Three components of strain, two principal strains and their azimuth, are derived from the observed three values. Since this method of strain measurement is new and different from the conventional one based on the changes in three separate distances, it is important to make the principle of operation well understood to avoid confusion.

In this report the basic equations, presented separately in several papers by the author, are gathered and arranged in a uniform manner. A major portion of this is concerned with the case where chamber partitions are assumed to be free from any resistive forces. Although this case is fictional the results will help us to understand the actual case where partitions have finite rigidity, and an approximate method of solution is presented.

The basic theory of the three-component strainmeter based on the method of measuring three diameter changes is also given in the appendix for comparison.

#### 1. はじめに

坂田式三成分ひずみ計は、筆者が防災科学技術研究所在職中に発明し(坂田, 1981), 実用化したものである。地震に伴うひずみステップを、到来方向を含め高精度で検知したことなどから、ボアホール式三成分ひずみ計としての信頼性が確立してきた(坂田, 1985; Sakata and Sato, 1986)。大地震に先行するプレスリップがあれば、これを検出する能力を持っていることから、地震の短期予知のための有力な観測装置としても期待されるばかりでなく、長周期のひずみ地震計としても利用できる(坂田, 1999)。現在このひずみ計は、高知大学(木村・川谷, 1992)、地質調査所(伊藤・桑原,