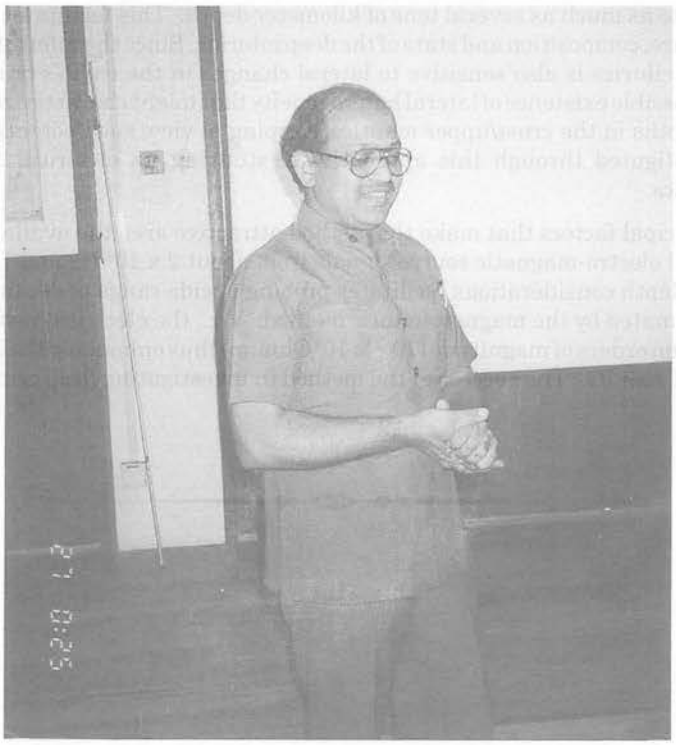
Magnetotelluric technique: a new geophysical tool for geological problems

T. HARINARAYANA

Abstrak (Abstract)

Magnetotelluric (MT) method aims at determining the subsurface electrical conductivity of the earth utilizing the natural electromagnetic signals of extraterrestrial origin. These signals referred to as "Magnetic Pulsations", are generated through the interaction of the Solar Wind with the Earth's Magnetosphere and of the Magnetosphere with the Ionosphere.

Frequencies of the pulsations can range from 5 Hz to several milli hertz. Further, the thunder storm activity occurring in the earth's ionospheric activity generates natural electromegnetic signals in the higher frequency range i.e. the Audio frequency band, extending up to a few tens of kHz.



Thus we have signals of natural electromagnetic field covering a wide band of frequencies ranging from a few thousands of secs (milli hertz) to a few kilohertz and these constitute the source field signals for the MT measurements.

The basic data acquisition in MT is accomplished through simultaneous measurement of orthogonal components of natural magnetic and the corresponding induced electric field variations. The relationship between the magnetic and electric field variations as measured on the earth's surface over through a parameter called impedance range of frequencies is expressed are converted into apparent resistivity and phase values and these provide the basic information about the earth's subsurface conductivity distribution. A study of the conductivity variation over a range of frequencies, and hence over a range of depth levels, provides a model for the subsurface geoelectric structure. Integration of this information with other geological and geophysical inputs leads to retrieval of realistic geological models.

The method is being increasingly deployed for handling a wide spectrum of geological/ geophysical problems, which includes deep crustal and mantle studies, sedimentary basin evaluation for hydrocarbon exploration, geothermal investigations and also for mineral exploration, engineering geology and other related problems. The success of the method in tackling various geological problems is discussed.