ON THE DETERMINATION OF EARTH CONDUCTIVITY FROM OBSERVED SURFACE POTENTIALS*

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If a direct current is supplied to the earth through a small electrode, a distribution of electrical potentials over the surrounding surface of the earth is produced. The variation of this potential with the distance from the electrode depends upon the manner in which the conductivity of the earth below the surface varies with the depth, the calculation of the potential when this conductivity is known being possible by familiar methods. From the standpoint of geophysics, however, it is most frequently the converse problem which is important. The surface potential is accessible, and is therefore at least theoretically measurable. From it the unknown subterranean conductivity is to be deduced. The discussions of this problem which are to be found in the geophysical literature have almost without exception been based upon considerations of the trial and error type. The potentials associated with a suitable set of hypothesized conductivities are computed, and by *fitting* observed potentials to these, as best may be, inferences about the unknown conductivity are sought.

A direct method, on the other hand, has been given recently by L. B. Slichter† and the present author.‡ It is assumed (as has generally been done) that the conductivity is a function only of the depth, and the Taylor's series expansion of this function is deduced from the surface potentials. The problem may, therefore, be regarded as solved whenever the conductivity function is one which is represented, at least to the depth in question, either by its Taylor's series directly or by analytic extensions of the same. The present paper is intended to extend the deductions to the case in which either the conductivity

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† L. B. Slichter, *The interpretation of the resistivity prospecting method for horizontal structures*, Physics, vol. 4 (1933), p. 307.

‡ R. E. Langer, *An inverse problem in differential equations*, this Bulletin, vol. 39 (1933), p. 814.