Estimating Earthing Resistance of Rod Electrode Using Finite-Element Method

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ABSTRACT

Earthing is an important technology in the fields of electric power, communication, and lightning protection. The earthing electrode is used as the ground and the electric terminal which comes in various shapes from small scale like rod-shaped and plate-shaped to large scale such as ring-shaped and mesh shaped. When designing earthing, its resistance which is an index of the rise in electric potential must be known. The earthing resistance of the electrode such as a rod-shaped and a plate-shaped is computed by approximated analysis. There are methods of earthing simulation such as the tank model method or Laplace numerical analysis equation method (for example, the finite element method) used to estimate a shaped earthing resistance without analytic answer. Finite-element analysis will be used to compute earth-resistance of rod-shape electrode in both homogeneous soil and multi-layer soil models.

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CHAPTER 1

INTRODUCTION

1.0 INTRODUCTION

The earthing system, sometimes simply called 'earthing', is the total set of measures used to connect an electrically conductive part to earth. The earthing system is an essential part of power networks at both high- and low-voltage levels. A good earthing system is required for protection of buildings and installations against lightning safety of human and animal life by limiting touch and step voltages to safe values. All these functions are provided by a single earthing system that has to be designed to fulfill all the requirements.

Grounding system is actually two different subjects, earth grounding and equipment grounding. Earth grounding is an intentional connection from a circuit conductor usually the neutral to a ground electrode placed in the earth. Equipment grounding is to ensure that operating equipment within a structure is properly grounded. These two grounding systems are required to be kept separate except for a connection between the two systems to prevent differences in potential from a possible flashover from a lightning strike. The importance of good earthing for efficient and reliable operation of modern power systems also cannot be underestimated. Various forms of electrode have been used to obtain a suitable earth resistance for different types of soil composition. Whereas vertical-rod electrodes are found to be suitable for most cases, horizontal, buried rods and strips are preferred where the soil is rocky below a small depth. A simple analytical approach to the design of a suitable earthing system for achieving a given specification is therefore extremely valuable.