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### **Abstract**

The software development of ac substation ground grid design using MATLAB should include two types of applications: a user ground grid design and a minimum ground grid design. The calculation procedure of both applications follows the guideline of IEEE 80-2013 ( Guide for Safety of AC Substation Grounding ) which requires that ,for compliance, the calculated maximum touch voltage and maximum step voltage be lower than the tolerable values based on human body weight. This research presents only the development of the user ground grid design software.

The proper function of a ground grid is crucial to the normal operation of a substation for a number of following reasons :

1 Equipotential bonding of conductive objects to the ground grid prevent the presence of dangerous voltages between objects. Moreover it prevents electrostatic buildup and discharge , which can cause sparks with enough energy to ignite flammable atmospheres.

2 The ground grid provides a low resistance return path for earth fault, which thereby protect both personnel and equipment inside the substation and outside the substation fence along the perimeter.

3 For earth faults with return paths to faraway generation sources, a low resistance ground grid relative to remote earth prevents dangerous ground potential rise (GPR) which is the cause of dangerous touch and step voltages.

4 The ground grid provides a low resistance path relative to remote earth for lightning current and surge current of surge arrestors.

5 The ground grid provides a reference potential for electronic circuits and helps reduce electrical noise for electronic ,instrumentation and communication systems.

Therefore a good design of it is of great importance. This developed software is applicable to only basic forms of ground grid area ,i.e., square, rectangular, triangular, T, and L shapes. For a case study and verification, the software has been used to design the ground grid of 24000-416/240 v, 2500 kVA , delta-wye grounded , transformer yard within Kasetsart University, Bangkok Campus, ground grid area of 12 m x 12 m. The software calculations were compared with hand calculations and found to provide acceptably accurate results.

**Keywords:** Ground grid, GPR, Touch voltage, Step voltage, MATLAB