



**Arab Academy for Science, Technology and Maritime Transport  
(AASTMT)  
College of Engineering and Technology  
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# **Design and Cost Optimization of Substation Grounding Mat Using Genetic Algorithm**

A thesis submitted to AASTMT in partial fulfillment of the requirements for the award of the degree of

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## **ABSTRACT:**

This thesis investigates problematic cases in AC substation grounding system design. Particularly, the grounding design for substations that are built on high resistivity soil is considered. The goal of the thesis is to improve upon the restrictions for the grounding grid design, while minimizing the material (i.e., copper conductors) and installation costs of a grid. The first part of the thesis includes the substation grounding design procedures and hand calculations according to IEEE Std. no.80-2000 and then a real case study for Khalda “El-Qasr” substation had been calculated. In The second part of the thesis, a CYMGRD program is used to check and compare the results that had been achieved by hand calculations. The final part of the thesis demonstrates how it is possible to optimize the configuration of the grounding grid itself, minimizing costs, and yet still achieving a safe installation using the Genetic Algorithm technique. This thesis shows how these construction and material savings are realized by utilizing a process whereby the grounding design minimizes the overall cost. The overall contribution of this thesis is the optimization of the grounding grid design by eliminating the restrictions found in the IEEE standards 80-2000 and offering an optimized grounding system design, starting from the soil model to the actual grounding mat design itself.

**Keywords:** AC substation grounding mat design, ground grid resistance, fault current and Design optimization.