

# **Boundary Element Software Packages for Solving Cathodic Protection Problems**

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## **ABSTRACT**

Corrosion is a natural phenomenon that occurs in metals when those are located in corrosive environments. Metals used for mechanical purposes are meant to be working in corrosive environments as offshore structures, subsoil provision even the atmospheric air is corrosive for metals. Therefore, a method to protect metals from corroding is necessary. Cathodic protection is a widely known method that protect metals from corroding. Cathodic protection is divided in two major protection categories. The first one is the method of sacrificial anodes and the second one is the method of impressed current density. Both those methods tend to protect the metal by converting the metal into a cathode. Designing a cathodic protection system requires an accurate determination of the electric potential and the current density, at the electrodes surfaces. Hence a proper modeling for the problem is extremely important. The most common methods to model a cathodic protection problem is the Boundary Element Method (BEM) and the Finite Element Method (FEM). The boundary element method is an ideal method to model and solve cathodic protection problems owning the fact that meshes only the boundary of the electrodes, in comparison to the finite element method that models the whole domain of the problem. In conclusion the boundary element method manages a more accurate analysis of the problem, with precise results and less computation time. For this project COMSOL Multiphysics and FEAC'S PITHIA was used, to simulate cathodic protection problems with BEM. The results from those two programs have been compared with the analytical results, which have been solved in a MATLAB developed programs.

Keywords:

Cathodic Protection, Corrosion, Boundary Element Method, Sacrificial Anodes,  
Impressed Current Cathodic Protection