Time-dependent CP simulation of wind turbine foundations

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ABSTRACT

Offshore wind industry is a relatively young market with continuous challenges in the development of durable wind mill foundations. Cathodic protection systems protect the submersed part of the foundation structure against internal and external corrosion and should be properly designed to accommodate the foundation geometry. During the last decennia the trend evolves from SACP towards ICCP systems with an increase acceptancy of computational modeling for achieving approval on the CP design.

A time-dependent simulation tool is presented that computes the electrochemical and homogeneous reactions taking place during CP operation. Boundary conditions are automatically updated after each time step. As a result the evolution of the protection potential and current density, the reduction in the corrosion rate and the growth of a calcareous layer are accurately calculated in a 3D model. In addition the produced gases (ventilation purposes) and the long-term chemical composition like pH of the confined water volume are computed for internal CP systems.

In general modeling allows anticipating on the CP design within certain static boundaries. The unique time dependent simulation approach as proposed in this paper offers the additional benefits that the CP effect is calculated in an cumulative manner such that the integrity of the foundation is accurately predicted over its entire design life.

Key words**:** time-dependent computational modeling, internal/external corrosion, wind turbine foundation