Anodic Protection Response to Pile Driving for Fix Steel Jackets

Seyed Saleh Hosseini Yazdi: Msc Student in Mechanical Engineering, University of Tehran:
salehhosseini@yahoo.com
Mohmmad Hassan Hedayati[**]**:** Msc in Structural Engineering, Petroiran Company Ltd:
mh.hedayati@petroiran.com

۱. Introduction

Offshore structures work in sever harsh environmental conditions which lead to high corrosion rates. To protect such these structures, various methods have been used. For example, for atmospheric and splash zones, proper covering protection systems have been employed. In Sub Sea zone due to environmental characteristics which is a solution of various salts, anodic protection system is practiced. The anodic protection system consists of a pipe or a tubular which is covered by a sacrificial substance. The sacrificial element due to difference between its natural galvanic potentials and main structure corrodes; therefore, it protects the main structure of corrosion and the sea water is the electrolyte. The tubular is the structural element which bears loads and connects the anode, structurally and electrically to the main structure. In normal conditions, the tubular only bears the sacrificial substance weight which when the offshore structure is in service a portion of the weight is neutralized by buoyancy. But in pile driving stage, the hammer impacts induce a series of impulses which applies a great amount of acceleration (force).
In general practices the common way to design anodic system and predict its behavior under such this condition, is using relative codes and standards and the equations and assumptions which are brought in them. In this study a typical anodic system which was used in South pars gas field development phases ۶, ۷&۸ is considered. The anode responses to pile driving impulses are modeled through proposed methods in codes and standards along with making an analytic model and FEA analysis, which the effect of sea water compensation is considered (Fig ۱a, ۱b and ۲).

۲. Pile driving:

According to South pars gas field development phases ۶, ۷&۸ Jacket pile analysis report document, it is found that the anodic protection members which are mounted on the jackets legs are subjected to ۲۵g acceleration during pile driving stage.

۲-۱. Standard based calculation method:

According to reference ۵:

$$a = ۲۵g \rightarrow \ddot{y} = ae^{-k.t}Cos\,\omega.t$$

$$\omega.t \rightarrow \infty \Rightarrow \begin{cases} \ddot{y} \rightarrow ۰ \\ y = ۰ \end{cases}$$

Where t is time, g is gravity acceleration, y the anode fluctuation position and $\ddot{y}$ is anode acceleration. It is assumed that:

$$\omega.t = ۱۰\pi \rightarrow \ddot{y} = ۰.۱g \Rightarrow \begin{cases} \omega.t = ۱۰\pi \\ \omega = \dfrac{۲\pi}{T} \end{cases} \Rightarrow t = ۵.T$$