Defense Announcement

Wireless Power Transfer Along Oil Pipe Using Ferrite Materials

Xiyao Xin

Degree: **PhD, Electrical Engineering**

Date: 04/13/2015 Time: 4:00-6:00pm

Location: ECE Large Conference Room

Committee Chair: Dr. Ji Chen

Committee Members: Dr. David R. Jackson
Dr. Stuart Long
Dr. Driss Benhaddou
Dr. George Zouridakis

Modern oil industry requires detailed monitoring and management to reduce the risks of unwanted fluid release. Sensors need to be planted along oil wells to gather the downhole environment data. However, there are production packers along oil pipes that are used to provide a seal between pipe casing and tubing to control pipe pressure. Such structure makes it difficult for power cables to extend along oil pipes. In order to provide power supply on both sides of production packers, we consider wireless power transfer technique via inductive magnetic coupling between two coils winded along oil pipes. But eddy current induced in metallic pipe and sea water in oil well will counteract the flux link between transmitting and receiving coils. Also, the distance of power transfer is limited due to the fast decay of inductive magnetic field.

In this research, we propose a long distance wireless power transfer system along oil pipe with acceptable efficiency. We cover the oil pipe with a thin layer of soft ferrite, and we add soft ferrite core to the transmitting and receiving coils. We use FEM simulation software to analyze the magnetic flux link improved by the ferrite structures. A CAD model is used to extract FEM field solutions to estimated power transfer efficiency, and the estimated efficiency is compared and validated with actual experiment measurement. We will show through FEM simulation and experiment that the ferrite layer on oil pipe forms a magnetic flux pathway and greatly enhance the flux link between transmitter and receiver, and by building a flux pathway extending through pipe, we are able to make the long distance wireless power transfer in oil well possible.