

Design and evaluation of Magnetic Induction Spectroscopy probe for pH measurement in fetal hypoxia using COMSOL Multiphysics Simulation

Abstract

Fetal Blood Sampling (FBS) is the term used to describe the current method of monitoring the foetal condition within the mother's womb. FBS required the medical officer to make a small incision on the foetus's head in order to collect blood for analysis of the blood pH level in order to prevent acidosis or foetal hypoxia. The FBS method, on the other hand, is invasive and increases the risk of infection for both mother and child. Magnetic Induction Spectroscopy (MIS) is a novel method for diagnosing the foetus's pH level that is non-invasive and non-intrusive. A single channel MIS system is composed of a transmitter (TX), a receiver (RX), and an electrical circuit that generates and receives magnetic fields in response to the conductivity of the sample (blood) due to the presence of weak electrolytes (H^+ and OH^-). The purpose of this research is to develop and evaluate five different designs of TX-RX coils. The coils are designed using the Planar Zero Flow Coil (PZFC) concept, which allows for multiple coil configurations and input-output configurations. The results show that Design 2 open set model was the optimal coil design for MIS system probe, as well as some contributions to the pH evaluation process.

Keywords

Fetal Hypoxia; Fetal Scalp; Magnetic Induction; pH; Spectroscopy