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86 - Numerical Simulation of Biomagnetic Field from Somatosensory Evoked Response

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Optically-pumped atomic magnetometers (OPMs) have seen great advancements over the past years and emerge as a promising alternative to the superconducting quantum interference device (SQUID) detector system that is currently used in magnetoencephalography (MEG). OPMs are more affordable to manufacture, and its sensitivity at room temperature is comparable to that of the SQUID detectors. Without the need for cryogens or a dewar, OPMs can be placed closer to the scalp, enhancing the strength of the signal, and reducing noise. Unlike SQUID sensors, OPMs need not be situated in a shielded room from surrounding fields, allowing for lower maintenance MEG systems. Some of the studies utilising MEG currently done by our group include eye blink, auditory evoked response, and somatosensory evoked response.

We would like to manufacture our own OPM sensors to replace the current SQUID sensors. To estimate the range of frequency wherein the OPM needs to operate, we will study the somatosensory evoked response (SEP), an electrical activity of the brain that is caused by physical stimulus. In particular, we will focus on median nerve and tibial nerve SEP, the former which delivers an electrical stimulus to the wrist, and the latter to the ankle.

The propagation of an action potential resulting from the stimulus is approximated as current impulses along the different nerve fibers. We numerically simulate the magnetic field of the axonal current of different nerve fibres by modelling the axonal current as current dipoles. Ultimately, we want to create a numerical model of the bio-magnetic field in the human brain that results from stimulus, which would allow us to determine the frequencies of operation of the OPMs.

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