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Contribution ID: **3787** Type: **Oral Competition (Graduate Student) / Compétition orale (Étudiant(e) du 2e ou 3e cycle)**

(G*) NIBLES: A Numeric Bloch Solver with Dynamic Relaxation Calculations for MRI System Design

Monday, June 19, 2023 5:00 PM (15 minutes)

Magnetic resonance imaging (MRI) is a powerful imaging technique for diagnosing disease. One major drawback of currently available MR systems is the cost of the high-field (>1T), general use magnets that are the current clinical standard. Thus, interest has grown in developing smaller, low-field, and diagnosis specific MR systems. These systems can reduce costs, and increase the accessibility of MRI by allowing MR systems to be used as part of bedside care. To aid in the design of new MR systems, we have developed the Numeric Integrator for the Bloch Equations (NIBLEs). NIBLEs is a Python 3 based simulation tool for simulating varied MR sequences and magnet configurations, with the aim of identifying the optimal system characteristics for a given use case to serve as a starting point for the development of specialized MR systems.

The NIBLEs toolset itself is divided into two main components; a toolset for defining sample properties to be used in later simulations, and a toolset for simulating MR hardware and experiments. The sample toolset allows a user to build a sample composed of spatially distributed magnetization vectors with varied properties used to simulate proton density, chemical shift, and NMR relaxation times. Meanwhile, the main simulator allows users to script an MR pulse sequence using functions that define the applied magnetic fields from the constituent components of an MR system (e.g. gradient coils and radiofrequency coils). This script provides the applied field and sample properties to the core solver, which uses a Runge- Kutta algorithm to numerically solve the Bloch equations to reproduce the signal space output of that experiment. Simulations will be presented to illustrate the capabilities of the NIBLEs solver to produce realistic results for NMR experiments, and MRI imaging protocols including Turbo Spin Echo and Gradient Echo imaging.

Keyword-1

Magnetic Resonance Imaging

Keyword-2

Simulation

Keyword-3

Author: Mr ADAMS, John (Western University)

Co-authors: Dr HANDLER, William (Western University); Dr CHRONIK, Blaine (Western University)

Presenter: Mr ADAMS, John (Western University)

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