

Stay on the beat with tensor-valued encoding: time-dependent diffusion and cell size estimation in ex vivo heart

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Reference

Lasič et al. Stay on the Beat With Tensor-Valued Encoding: Time-Dependent Diffusion and Cell Size Estimation in ex vivo Heart, *Front Phys* 2022; 10:1–19.

<https://doi.org/10.3389/fphy.2022.812115>

Additional resources

[FWF sequence GIT repository](#) and the [GIT repository](#) for Lasič et al. *NMR in Biomedicine*, 2020;33:e4213. doi:

<https://doi.org/10.1002/nbm.4213>.

Overview

Matlab code used for the publication:

[Lasič et al. Stay on the Beat With Tensor-Valued Encoding: Time-Dependent Diffusion and Cell Size Estimation in ex vivo Heart, *Front Phys* 2022; 10:1–19.](#)

Code written by Samo Lasič. Datasets produced by Irvin Teh.

- `wfm_analyze.m`
Analyze and plot b-tensor waveforms (time and frequency domain, b-tensor shape and q-trajectory).
Makes the `*_info.mat` files in the *waveform* folders.
- `extract_spectral_trace.m`
Extract spectral traces (saved in the waveform folders), which are used by `make_lookup_table_DvsR_mouse.m` and `differential_sensitivity.m`
- `differential_sensitivity.m`
Plot differential sensitivity vs. R_{ω} .
Uses `spectral_traces.mat`.
- `DvsR_substrates.m`
Calculate ADCs for various waveforms and substrates (with varying compartment size and shape).
Makes `DvsR_*.mat` files in the *model* folders.

- `signal_MD_vsb_vsR_cylinder.m`
Plot $S(b,R)$ and $MD(\bar{b},R)$ for cylinders.
Makes `*_signal_fig_data.mat` file in the *model* folder.
- `noise_simulation_cylinder.m`
Perform noise simulations, calculate signal error as a function of f_R and SNR and generate figures for cylinders.
Makes `*_noise_fig_data.mat` files in the *model* folder.
- `noise_simulation_asymmetric_cylinder.m`
Perform noise simulations, calculate signal error as a function of f_R and SNR and generate figures for asymmetric cylinders.
Makes `*_noise_fig_data.mat` files in the *model* folder.
- `noise_simulation_spheroid.m`
Perform noise simulations, calculate signal error as a function of f_R and SNR and generate figures for spheroids.
Makes `*_noise_fig_data.mat` files in the *model* folder.
- `make_lookup_table_DvsR_pig.m` and `make_lookup_table_DvsR_mouse.m`
Calculate lookup tables: MD vs cylinder R vs waveform.
The tables are used for fitting and are saved in the *data* folders.
- `fit_MDvsWaveform_pig.m` and `fit_MDvsWaveform_mouse.m`
Fit and plot mouse and pig heart data with the hindered-restricted model using lookup tables. Saves fitting results in the *data* subfolders.
- `test_background_cross_terms_wfm.m`
Calculate normalized encoding spectra by including the effects of background gradients.
Saves results in `wfms_background_info.mat` in the *waveform* folder.
- `test_background_cross_terms_attenuation.m`
Calculate attenuation terms for various waveforms and background gradients (cylindrical geometry)
Uses `wfms_background_info.mat` and makes `attenuation_cylinder.mat` file in the *model* folder.
- `test_background_cross_terms_signal_cylinder.m`
Calculate and plot signals due to background gradients for cylinder powders as a function of b , G_b and direction.
Uses `attenuation_cylinder.mat` file in the *model* folder.
- `test_background_cross_terms_signal_IVIM.m`
Calculate and plot signals due to background gradients for IVIM as a function of b , G_b and direction.