**Fitting parameters to experimental MEPS**

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**Finding synaptic couplings from a biophysical model of motor evoked potentials after theta-burst transcranial magnetic stimulation**

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**Summary**

The code is written in Matlab and uses the statistics toolbox. It takes experimental MEP data and fits a model (as detailed in [1] and available at [2]) to each person’s IO curve. In practice, to save time, a look-up table of MEP curves for different parameter sets is used.

**Note on file structure:** If the user wishes to carry out the full calculations (rather than using a previously-calculated look-up table) they should install these files in the same directory ‘MEP\_model’ as used for [2]. If a look-up table is used (supplied in this depository) then the directory location doesn’t matter.

Download all files from the repository into the chosen directory.

To run, open Matlab and run the file *fit\_weights\_to\_goldsworthy\_vallence\_rel\_oct22.m* . To set the model used (e.g. ee, ie+ee, S+ee etc) there are various options at the top of this .m file, as detailed in the comments.

**General Principles**

The code loads the experimentally-measured MEP data. It loops through each person in turn, first fitting an IO curve for their baseline data, and then, using different parameter freedoms, an IO curve to their post-TBS experimental data. Finally, various analyses of the data are carried out.

**Files**

*fit\_weights\_to\_goldsworthy\_vallence\_rel\_oct22.m* --- The main code, which uses the following

*vallence\_cTBS\_3\_sessions\_10aug20.csv* --- This is a data file containing the results

of the cTBS experiments

*goldsworthy\_iTBS\_10aug20.csv* --- This is a data file containing the results

of the iTBS experiments

*fit\_weights\_to\_meps\_rel\_oct22.m* --- A function that performs the fitting.

There are various options at the top of the

code which shouldn’t require changing

*plot\_IO.m* --- A function that plots the MEP IO curves

fit\_and\_correlate.m --- A function that fits a straight line to data

and plots the fit on the graph. It calls…

*first\_order\_line\_mtw.m* --- which returns residuals to the fit

*plot\_big\_figure\_for\_paper.m* --- A function to plots graphs for the paper,

which calls from…

plot\_IO\_2.m --- Plots MEP curves (slightly different to

Plot\_IO.m)

fit\_weights\_to\_meps\_rel\_oct22.m can be run either drawing from a previously-evaluated look-up table (set use\_matrix=true and just\_do\_plots=true in the function options) or doing an IO curve calculation each call (set use\_matrix=false and just\_do\_plots=false).

If the former look-up is done (the standard option), the code is much faster. The routine uses

*enormous\_interpolated\_results\_p7122.mat*  --- The look-up table of IO curves for

different wee and wie combinations

If the latter (full calculation) is done, the following routines will also be needed, in addition to NFTsim [3] and the MEP model described in [1] and available at [2]. It is much slower.

*create\_person.m* --- Creates a .conf file for NFTsim by copying

the file IO\_master\_conf\_file.conf

*change\_weights\_ee.m* --- Writes a wee weight into a .conf file

*change\_weights\_ie.m* --- Writes a wie weight into a .conf file

*run\_IO\_curve.m* --- Runs the IO curve using the model of [1]

and also the NFTsim .conf template

*IO\_master\_conf\_file.conf*

**Output**

Various plots are numerical output is produced, but notably for the purposes of the publication there are Figures 200 and 201 which relate directly to plots in the submitted manuscript.

**References**

[1] Marcus T. Wilson, Bahar Moezzi, Nigel C. Rogasch. (2021). Modeling motor-evoked potentials from neural field simulations of transcranial magnetic stimulation, Clinical Neurophysiology, Volume 132, Issue 2, <https://doi.org/10.1016/j.clinph.2020.10.032>.

[2] <https://github.com/mtwilson1970/MEP_modeling_2020>

[3] <https://github.com/BrainDynamicsUSYD/nftsim>