

Brain Dynamics Toolbox

Version 2017c (pre-release)

The [Brain Dynamics Toolbox](#) provides a convenient graphical user interface for exploring dynamical systems in MATLAB. Users implement their own dynamical equations (as matlab scripts) and use the toolbox graphical interface to view phase portraits and other plots in real-time. The same models can also be run as MATLAB scripts without the graphics interface. The toolbox includes solvers for Ordinary Differential Equations (ODE), Delay Differential Equations (DDE) and Stochastic Differential Equations (SDE). The plotting tools are modular so that users can create custom plots according to their needs. Custom solver routines can also be used. The user interface is designed for dynamical systems with large numbers of variables and parameters, as is often the case in dynamical models of the brain. Hence the name, *Brain Dynamics Toolbox*.

Download

Download the latest release from the [bdtoolkit](#) repository on GitHub

Getting Started

The toolbox requires MATLAB 2014b or newer. Unzip the toolbox files into a directory of your choosing. The main toolbox scripts are located in the *bdtoolkit* directory which must be in your matlab PATH variable. The *bdtoolkit/models* directory contains example scripts that are also advisable to have in your PATH.

```
$ unzip bdtoolkit-2017c.zip
$ matlab
>> addpath bdtoolkit-2017c
>> addpath bdtoolkit-2017c/models
```

Refer to the *Getting Started* section of the *Handbook for the Brain Dynamics Toolbox* for more. It can be purchased in paperback or ebook formats from Amazon booksellers. Chapter 1 of the handbook is available for free on the [Brain Dynamics Toolbox](#) website.

The official guide to the **Brain Dynamics Toolbox**

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The *Brain Dynamics Toolbox* is an open-source software application for simulating and exploring user-defined dynamical systems in Matlab. It supports the major classes of dynamical systems that arise in Computational Neuroscience — Ordinary Differential Equations, Delay Differential Equations and Stochastic Differential Equations.

This book is for researchers, engineers and students who wish to use the toolbox to construct mathematical models of brain function. It assumes a working knowledge of Matlab and the numerical methods for solving initial value problems in non-linear dynamical systems.

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Professor Michael Breakspear is Senior Scientist and Group Leader of the Systems Neuroscience Group at QIMR Berghofer Medical Research Institute. He is interested in the fundamental principles of large-scale brain dynamics, how these arise from cortical architectures, and how they underpin cognitive operations.

Handbook for the Brain Dynamics Toolbox

Version 2017c

Computational Neuroscience

QIMR Berghofer Medical Research Institute

Heitmann S & Breakspear M (2017) Handbook for the Brain Dynamics Toolbox, Version 2017c. *QIMR Berghofer Medical Research Institute*.

Example Models

- *BrownianMotion* : Geometric Brownian motion.
- *BTF2003* : Neural mass networks with delays and noise (Breakspear, Terry, Friston, 2003)
- *FitzhughNagumo* : FitzHugh-Nagumo neural oscillator.
- *FRRB2012* : Multistable neural oscillators with noise (Freyer, Roberts, Ritter, Breakspear, 2012)
- *DFCL2009* : Neural mass model with chaos (Dafilis, Frasca, Cadusch, Liley, 2009)
- *HindmarshRose* : Network of Hindmarsh-Rose neurons.
- *HopfieldNet* : Generalised Hopfield Associative Memory Network.
- *KuramotoNet* : Network of Kuramoto phase oscillators.
- *LinearODE* : Example of a simple Ordinary Differential Equation.
- *MultiplicativeNoise* : Example of a simple Stochastic Differential Equation.
- *OrnsteinUhlenbeck* : Independent Ornstein-Uhlenbeck stochastic processes.
- *RFB2017* : Neural mass with multiplicative noise (Roberts, Friston, Breakspear, 2017).
- *SwiftHohenberg1D* : Swift-Hohenberg PDE in one spatial dimension.

- *VanDerPolOscillators* : Network of Van der Pol oscillators.
- *WaveEquation1D* : Wave equation PDE in one spatial dimension.
- *WilleBaker* : Example of a simple Delay Differential Equation.

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