University of BRISTOL

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A year in the life of Mark

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Today's agenda

- A brief summary of things
- More CBC
- Results so far
- Current work

What am I doing?

- Neurons are interesting
- Nonlinear dynamics teaches us lots about neurons
- Models are wrong

How am I doing it?

- Models are often analysed using numerical continuation
- Numerical continuation needs a model
- Control-based continuation doesn't

What needs to be done?

- Make it fast
- Make it noise-robust
- Make it happen

How are those TODOs progressing?

- Efficiency
  - Current work; lots of problems, lots of progress
- Noise-robustness
  - One paper under review
  - Other ideas under consideration
- Experiments
  - Minireview of literature
  - Some practical experience

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Control-based continuation

- CBC works by tracking non-invasive control targets
- It has been tested on ‘nice’ systems, but biological systems aren’t nice
- Discretisation is a key part of this

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Paper 1: a tutorial

Tutorial of numerical continuation for systems and synthetic biology

Paper 2: on noise-robustness

Bayesian local surrogate models for the control-based continuation of multiple-timescale systems

- Noise-robustness is important in CBC
- Surrogate modelling is a possible route towards noise-robust experiments

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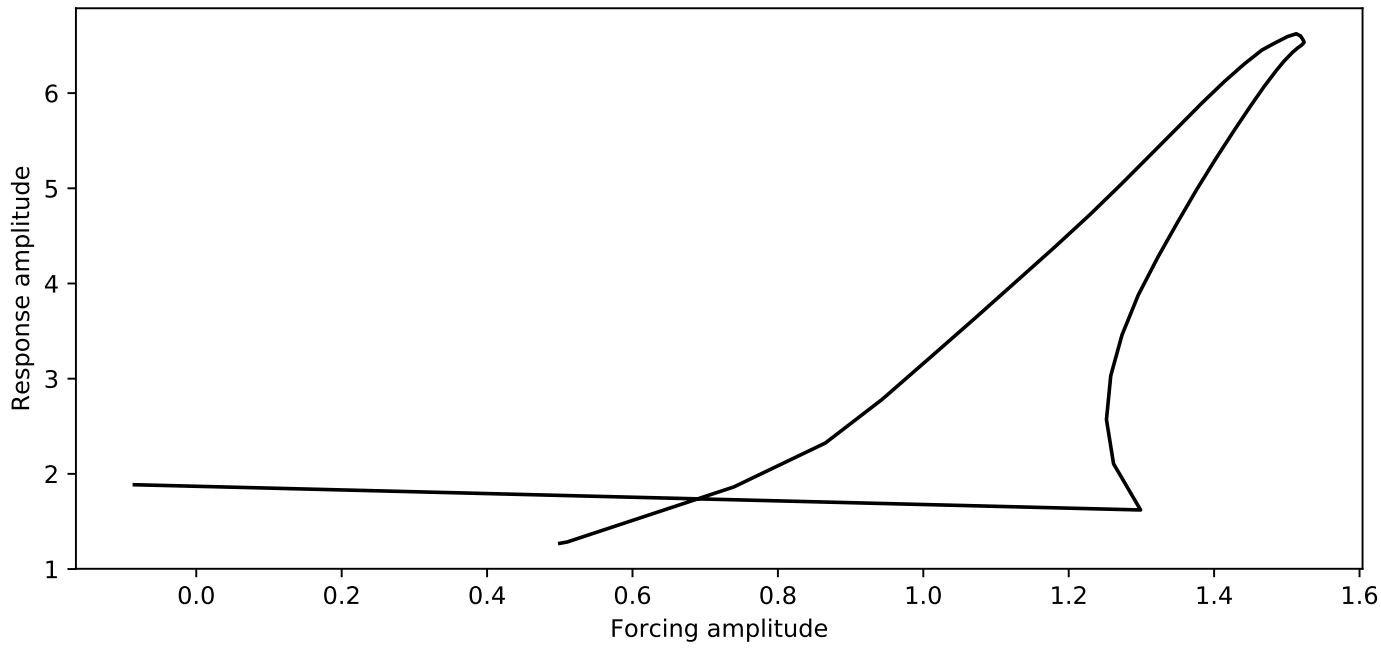
Periodic splines discretisation

- Discretisation is important
- Efficiency is also important
- Splines could be efficient discretisors

Current issues



- Newton solvers don’t converge on a solution
- The solution curve becomes numerically unstable