Christmas Blitz 2018

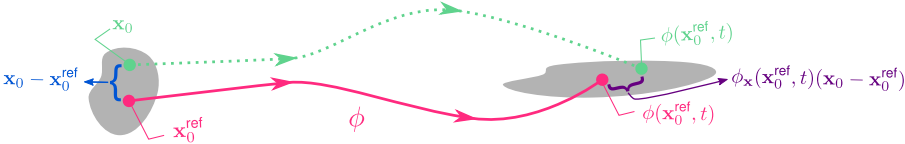**Eoghan J. Staunton**, Petri T. Piiroinen

11, December 2018

NUI Galway
OÉ Gaillimh

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Linearisation

In a smooth dynamical system the characteristics of a given reference trajectory can be determined by examining the linearised system about the reference trajectory.
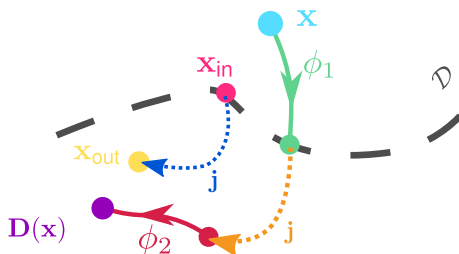

This form of analysis cannot be used in nonsmooth systems as $\mathbf{f}$ is not everywhere differentiable, or $\phi(\mathbf{x}_0^{\text{ref}}, t)$ is not continuous.
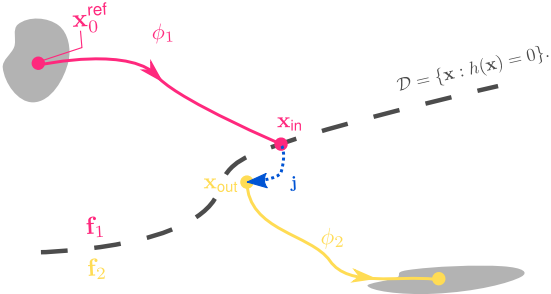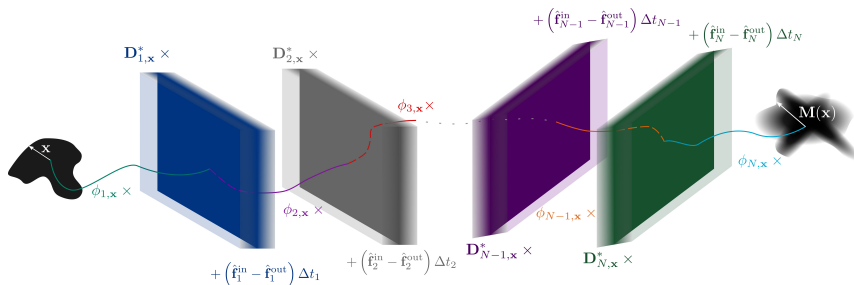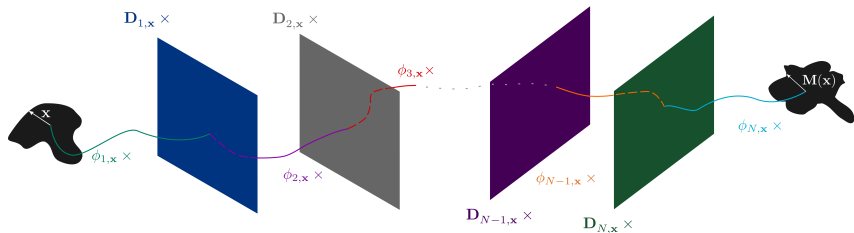
The Saltation Matrix

To account for this we derive the zero-time discontinuity mapping (ZDM).

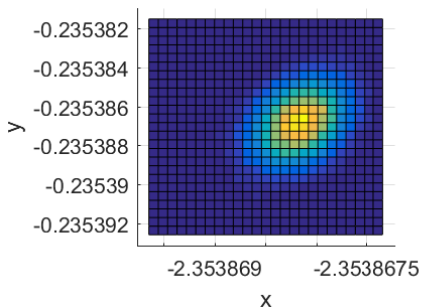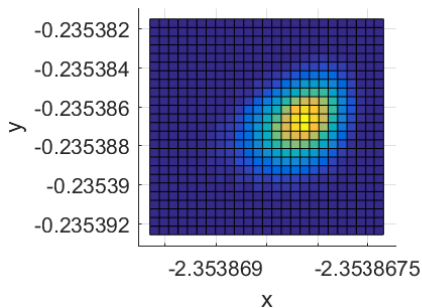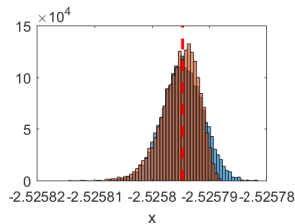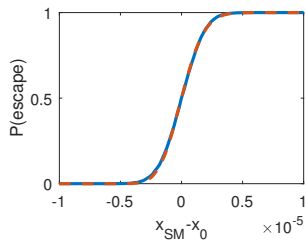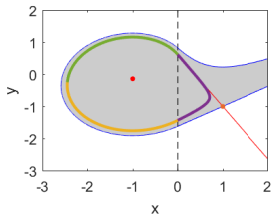The Jacobian derivative of $\mathbf{D}$ evaluated at $\mathbf{x}_{\text{in}}$ is called the *saltation matrix*. This matrix allows us to compose the Jacobians of the individual flows to give the overall Jacobian

$$\phi_{\mathbf{x}}(\mathbf{x}_0^{\text{ref}}, T) = \phi_{2,\mathbf{x}}(\mathbf{x}_{\text{out}}, T - t_{\text{ref}})\mathbf{D}_{\mathbf{x}}(\mathbf{x}_{\text{in}})\phi_{1,\mathbf{x}}(\mathbf{x}_{\text{in}}, t_{\text{ref}}). \tag{1}$$
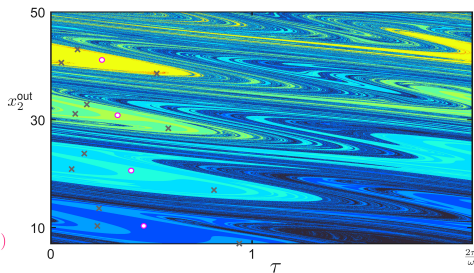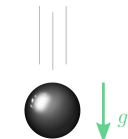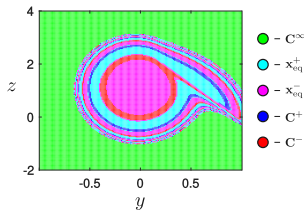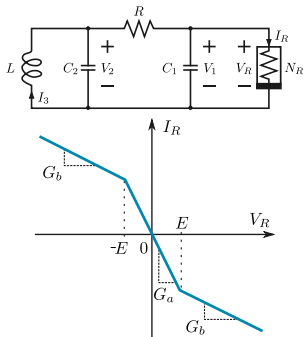
Adding Noise to the Boundary

A PWL Example

Future Plans