Discrete Bifurcation Analysis of Reactive Systems

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- **Bifurcation Analysis**: *Qualitatively* classify system’s behaviour with respect to parameters → **bifurcation points**.
- Behaviour can be described in terms of phase portraits, or **patterns**.

State-of-the-art bifurcation analysis techniques are hard to automate and scale poorly in the number of parameters.

![Phase Portrait Diagram](image)
Pattern can be described in terms of **temporal logics** on a general parametrised transition system.

- **HUCTL** with hybrid, directional and backward operators as pattern specification language.

- Implemented in an open-source tool PITHYA.

- **cycle** State $x$ lies on a cycle (not necessarily stable).
  
  \[ \text{[bind } x: \text{ EX } EF \ x] \]

- **stable** State $x$ lies in a stable component.
  
  \[ \text{[bind } x: \text{ AG } EF \ x] \]