MATCONT for Bifurcation Analysis

MCB Course, UBC
William R. Holmes

MATCONT

- Matlab based package for:
  - Integrating systems of ODE's,
  - Continuation of equilibria and detection of bifurcations,
  - And much more.

Development

- http://www.matcont.ugent.be/
- Developed by W. Govaerts and Yu.A. Kuznetsov

Alternatives

- Auto - Fast and efficient
- XPP Auto - Nice GUI
- GRIND
- LOCA (Very large scale)

Matcont Benefits (my opinion)

- Matlab based.
    - Easy to post-process data.
- Small learning curve if you know Matlab.
    - Basic tasks are easy.
- Platform independent.
- GUI based with command line support.

Matcont downside (my opinion)

- Fairly new and not comprehensive.
  - Doesn't plot vector fields.
  - Doesn't plot invariant manifolds.
  - No PDE support.
- Limited graphics capabilities (same with other packages).
- Requires Matlab = $$$

Instillation

- Download zip file of most recent version from website.
- Unzip the file where ever you like.
- Open Matlab and move into that folder.
- Type ‘matcont’ at the command line and the GUI will open.
- See documentation on sourceforge for more info.

Note

- The Matcont website has tutorials that are helpful.
- The manual is helpful for learning finer points.

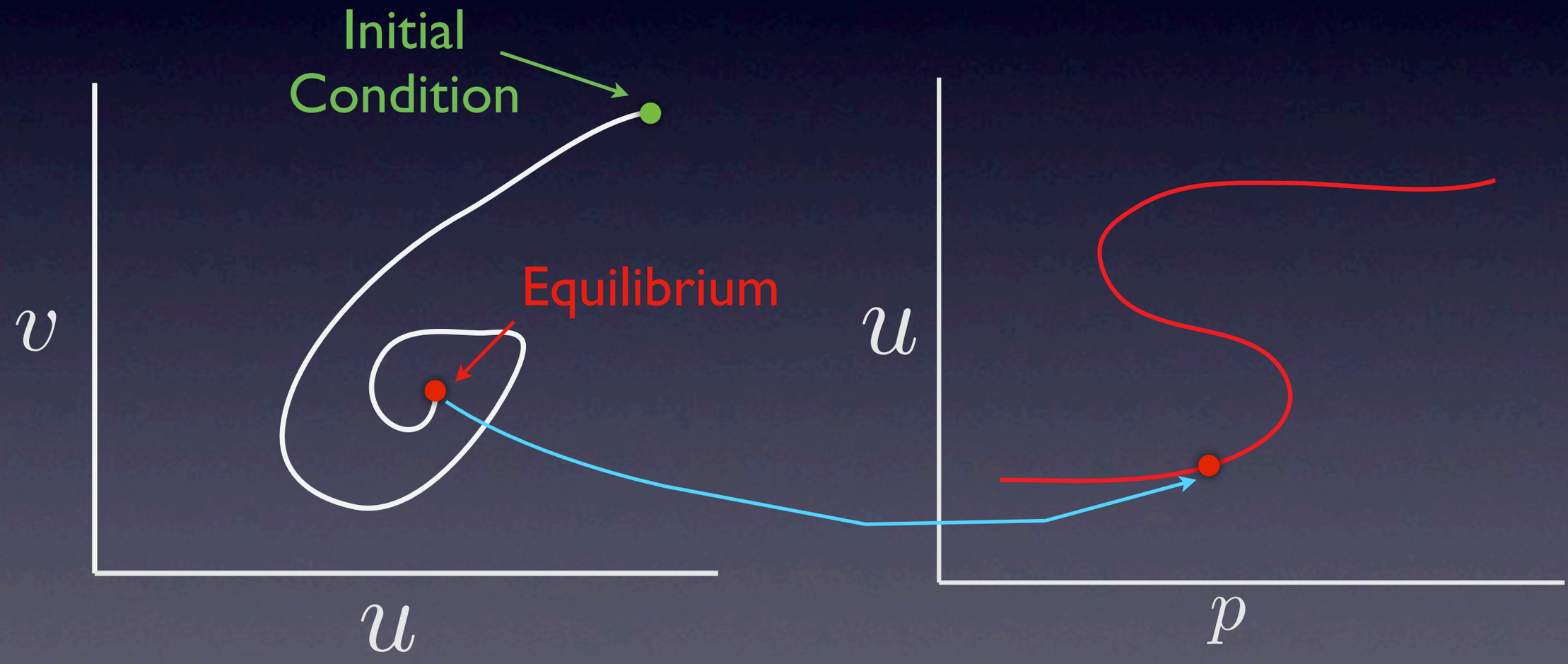
Continuation Procedure

- Find an equilibrium solution for a specific parameter set.
- Continue that solution with respect to that parameter.

Continuation Procedure

Time Integration

Continuation



Pitchfork Bifurcation

$$\frac{dx}{dt} = rx - x^3$$

$r < 0$ $\quad x = 0$

$r \geq 0$ $\quad x = 0, \pm\sqrt{r}$

Pitchfork Bifurcation