
Using XPP for dynamical systems

Caner Kazanci

University of Georgia
Department of Mathematics

Competition model

$$\dot{u} = u(1 - u - av)$$

$$\dot{v} = v(1 - bu - v)$$

Possible outcomes:

- ◇ Winner depends on initial conditions
- ◇ Superior competitor always wins
- ◇ There exists stable coexistence

XPP ode file

```
# XPP will disregard lines starting with #  
u'=u*(1-u-a*v)  
v'=v*(1-b*u-v)  
# list the parameters par a=1.2,b=.8  
# the rest is not required, can be adjusted  
within XPP  
# axis boundaries  
@ xlo=0,ylo=0,xhi=1.2,yhi=1.2  
# axis variables  
@ xp=u,yp=v  
done
```

Initial Analysis

◇ Display Null-clines

▷ Nullclines → New

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◇ Display flows on a grid

▷ `Dir.field/flow` → `Flow`

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▷ `Dir.field/flow` → `Flow`

◇ View stable/unstable invariant sets

▷ `Sing pts` → `Mouse`
press `Esc` as necessary

Displaying data

- ◇ Initial Conditions
On toolbar: [ICs](#)

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- ◇ Model parameters
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- ◇ Simulation Data
On toolbar: [Data](#)

Useful actions

◇ Enter initial conditions

`Initialconds` → `Go, Mouse, MICE, Last`

Useful actions

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◇ Change Axis

Viewaxis → 2D

or Xi vs t

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◇ See multiple graphs

Makewindow → Create

Useful actions

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Initialconds → Go, Mouse, MICE, Last
- ◇ Change Axis
Viewaxis → 2D
or Xi vs t
- ◇ See multiple graphs
Makewindow → Create
- ◇ Adjust Numerical Parameters
Numerics → Dt, Method, Bounds

Extras

- ◇ Assign model parameters to sliders for easier analysis (Three windows in bottom toolbar)

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- ◇ Assign model parameters to sliders for easier analysis (Three windows in bottom toolbar)
- ◇ Bifurcation Analysis
`File → Auto`