

Intermed. DiffEQ, Nonlinear Dynamics

Physics 413, Math 404 at [University of Michigan](#)

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Fixed points can change, called bifurcation. Normal form of “Saddle Node” bifurcations is

$$\dot{x} = r + x^2$$

r is parameter, fixed points depend on r .

Transcritical bifurcations are when there must be a critical point, but the stability of that point can change.

Normal form of transcritical bifurcations is

$$\dot{x} = rx - x^2$$

Normal form of supercritical pitchfork bifurcation:

$$\dot{x} = rx - x^3$$

Normal form of subcritical pitchfork bifurcation:

$$\dot{x} = rx + x^3$$