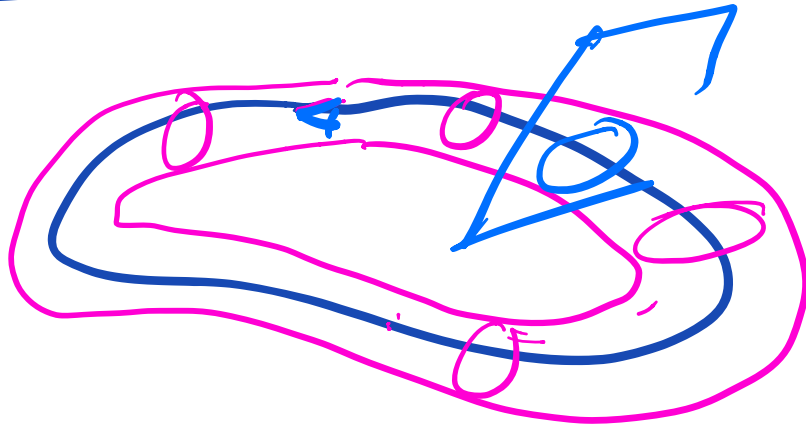


Def. Limit Cycle



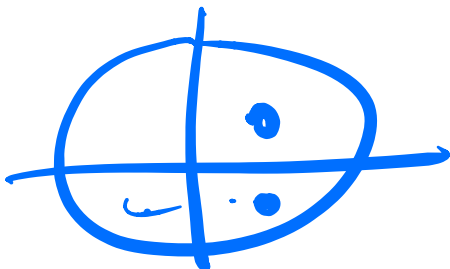
Poincaré Map μ - next Case 1

$\dot{Y} = F(X)$ and Map μ near

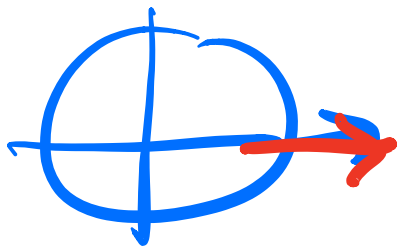
$$\underline{\underline{Y = AX}} \quad v \text{ eigenvector}$$
$$\underline{\underline{Av = \lambda v}}$$

$$Y = F(v) = \lambda v$$

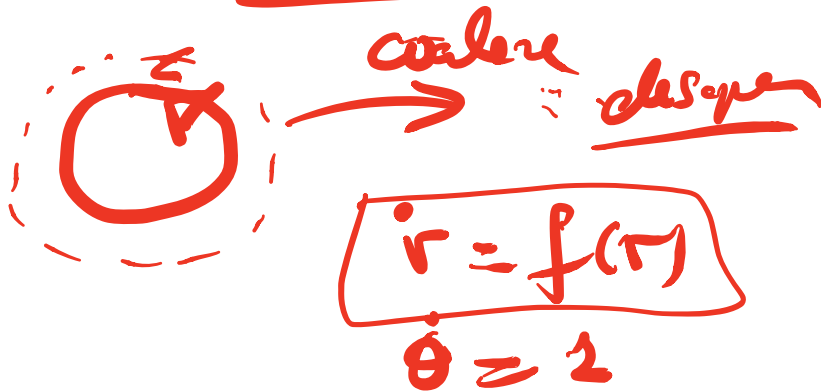
$$F^n(v) = \lambda^n v$$



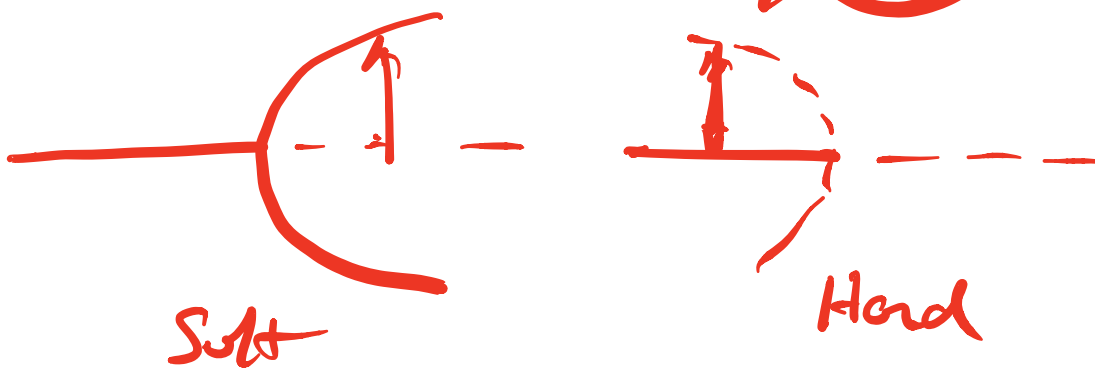
Case 1.1 Eigenvalues cross unit circle $n=1$



Saddle Node

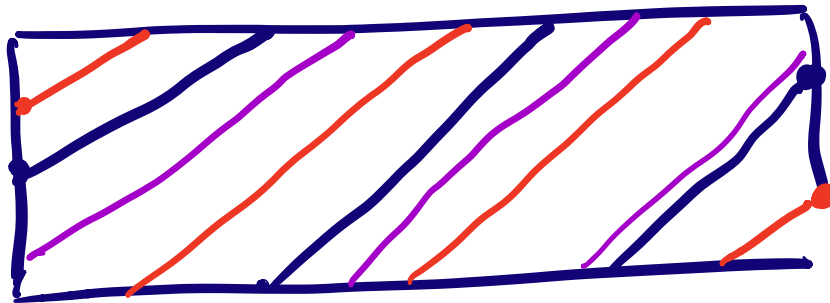
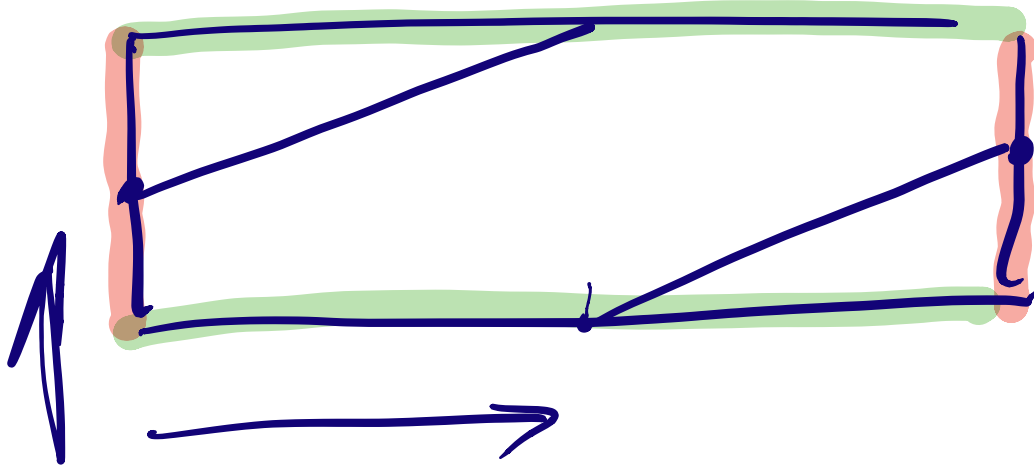
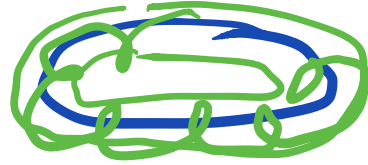


Case 1.2 Cross unit circle through -1



Case 1.3 2 eigenvalues (c.c.) cross unit circle

Hop on a hop



Care

Polycare Map does
not survive

Period double route to check

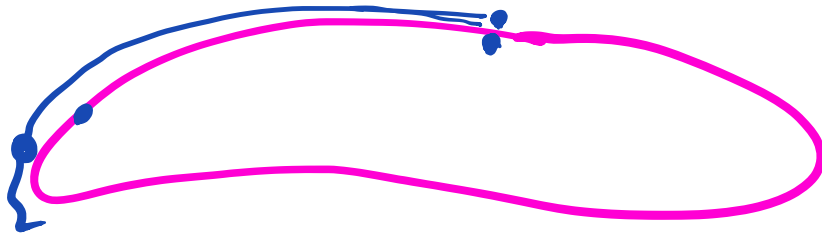
Reversible Turing? route to chaos

Landau

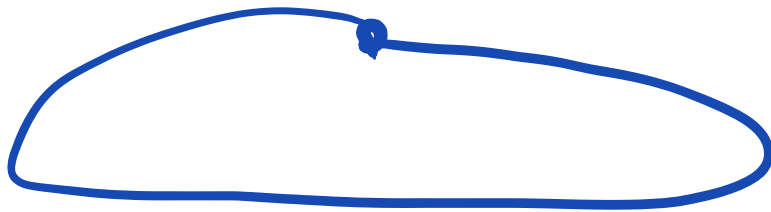
periodic $f(t) = \sum f_n e^{in\omega t}$

2 period $f(t) = \sum_{n,m} f_{nm} e^{i(n\omega_1 + m\omega_2)t}$

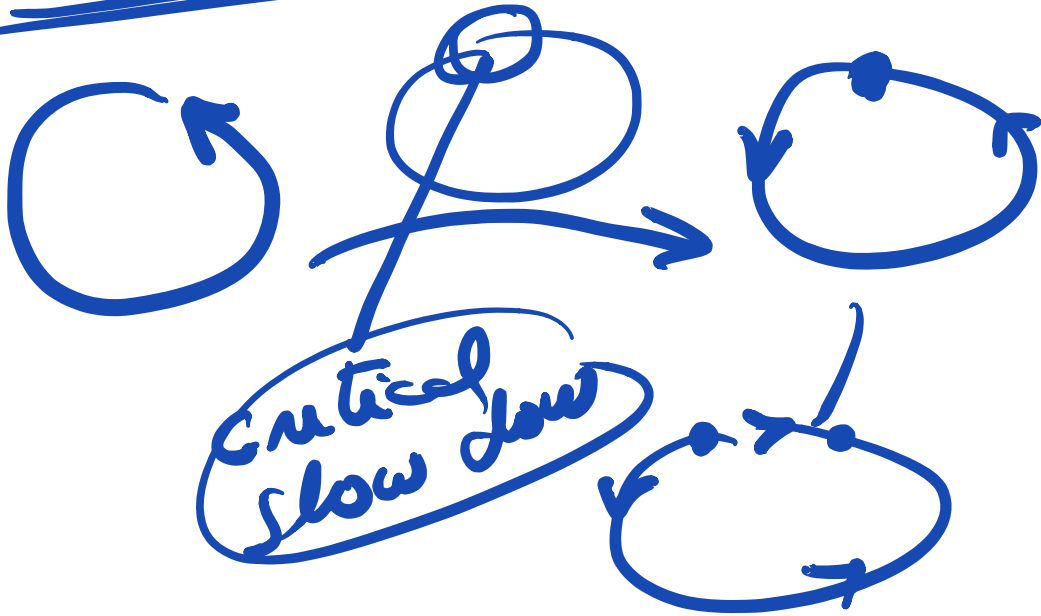
3 period $f(t) = \sum_{n,m,l} f_{nml} e^{i(n\omega_1 + m\omega_2 + l\omega_3)t}$



Core 2 No Power Map



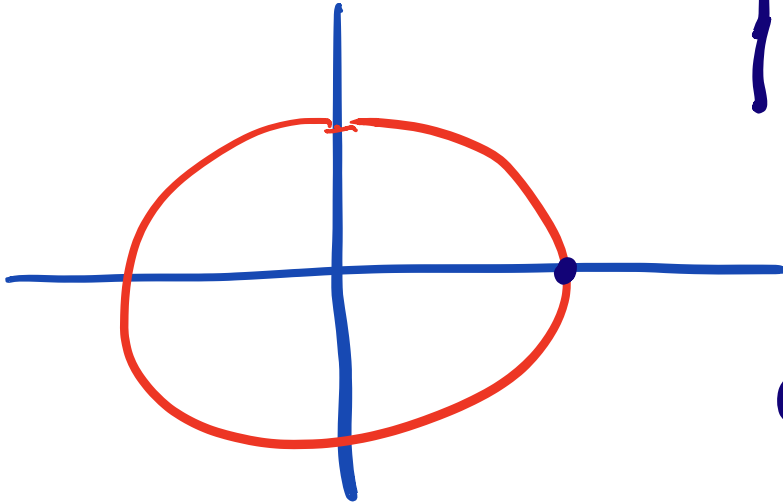
Infinite period bif.



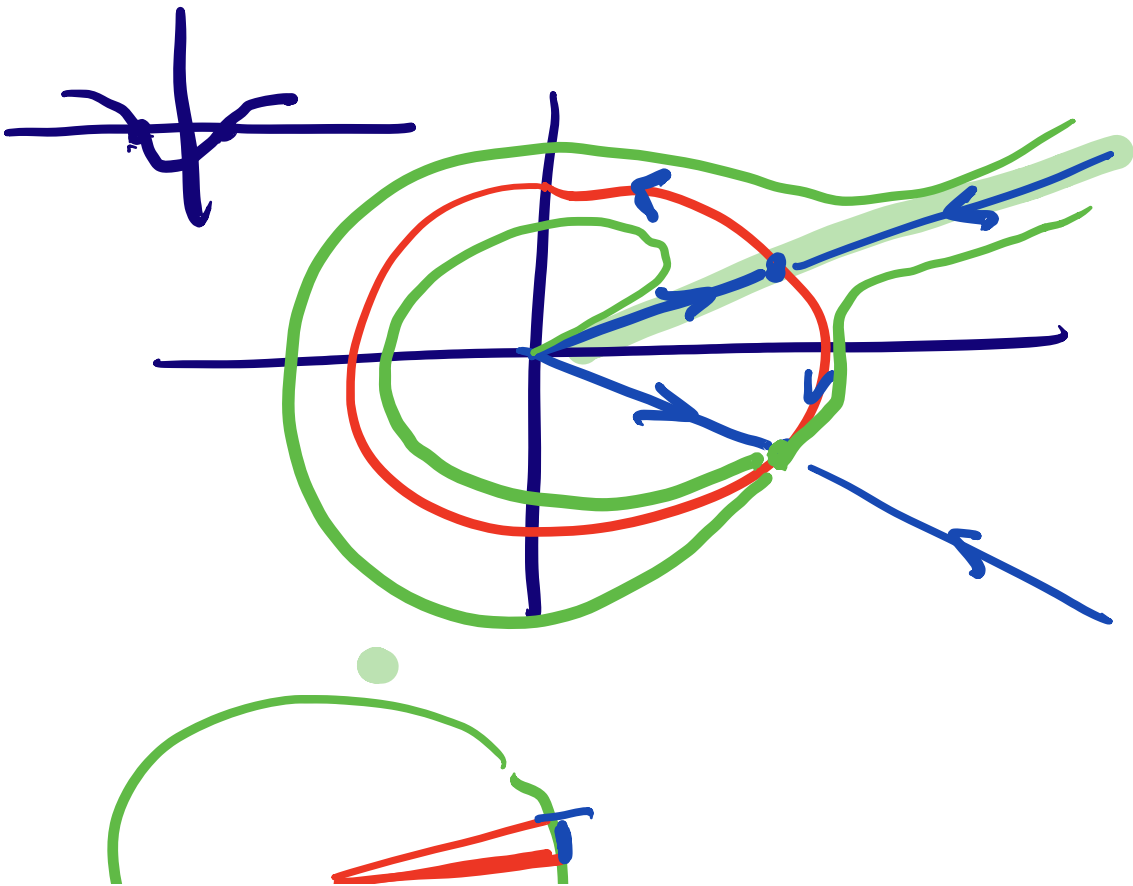
$$\dot{r} = r(1-r^2) \quad \boxed{r \rightarrow 1}$$

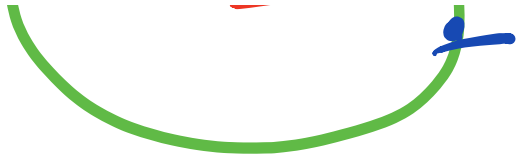
$$\dot{\theta} = 1 - a \cos \theta$$

$$\begin{aligned} |a| < 1 \\ \Rightarrow \\ \dot{\theta} > 0 \end{aligned}$$

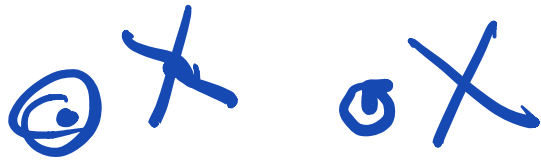


$$a > 1 \\ \Rightarrow$$





Hand-drawn Ref
of limit
of ϵ



TABLE

Type	Amplitude	period
Heart	$O(\sqrt{d})$	$O(1)$
Saddle Node	$O(1)$	$O(1)$
Infinite period	$O(1)$	$O(1/\sqrt{d})$
Homoclinic	$O(1)$	$O(\log d)$
period doubling	$O(1)$	gets double
<u>Wobbling</u>	$O(1)$	new $O(1)$ period shows up

$d = |\lambda - \lambda_c|$
 ↑ ref. parameter

$x(t), y(t)$, $z(t)$

