This GitHub site has code used for the paper “Anti-synchrony subspaces of weighted networks” by Niholt, Sieben and Swift.

The schematic function, for plotting, is y12: (R^2)^2 -> R^2. In makes a list of {u1, u2} that produces two plots.
The parameters are ϵ and κ, Greek letters that Mathematica allows us to use.

In[ ]:=
```
f[{u_, v_}] := {v, ϵ (1 - u^2) v - u} (* van der pol *)
H = {{0, 0}, {1, 0}};
Ht = Transpose[H];
Clear[x];
x[t_] := {{x11[t], x12[t]}, {x21[t], x22[t]}}
y12[x_] := {x[[1, 1]], x[[2, 1]]}
(* The schematic function.  This plots u1 and u2 *)

ϵ = 2;
κ = .5;
A = κ {{0, 0}, {1, 1}};
L = κ {{0, 0}, {-1, 1}};
M = A;
printInfo := Module[{},
  Print["x' = f[x] + M x H^T, f[u,v] = ", f[{u, v}], ", H = ", MatrixForm[H]];
  Print["ϵ = ", ϵ, ", κ = ", κ, ", M = ", κ, MatrixForm[Chop[M / κ]]];
  Print["x[0] = ", x0]
 ]
myPlotStyle = {{Red}, {Blue, Dashed}};
myPlotRange = {-2.2, 2.2};
```

Comment out the SeedRandom[1] command and run the cell to get different initial conditions.

In[ ]:=
```
SeedRandom[1];
x0 = RandomReal[{-2, 2}, {2, 2}];
```

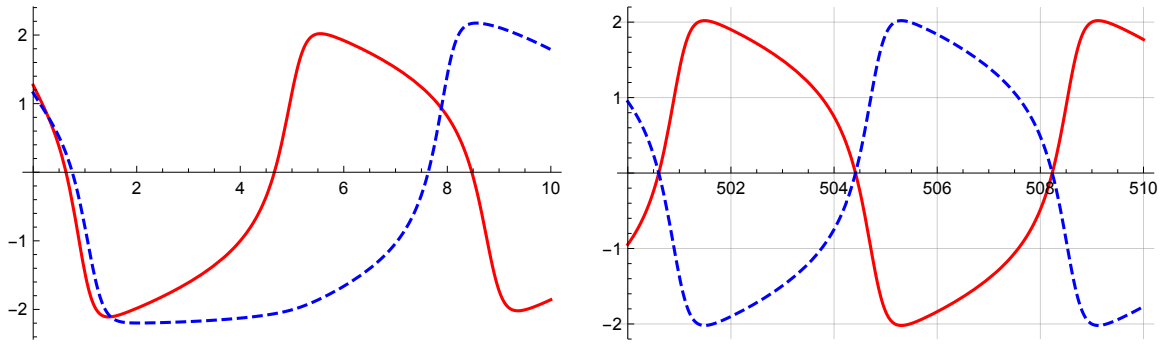
In[•]:=
```
ode = x'[t] == Map[f, x[t]] + M.x[t].Ht;
ic = x[0] == x0;
ivp = LogicalExpand[ode && ic];
tPlot = 10;
tTransient = 500;
tMax = tTransient + tPlot;
s = NDSolve[ivp, x[t], {t, 0, tMax}][[1]];
(* s is the first and only solution *)
p1 = Plot[Evaluate[y12[x[t] /. s]],
   {t, 0, tPlot}, PlotStyle → myPlotStyle, PlotRange → All];
p2 = Plot[Evaluate[y12[x[t] /. s]], {t, tTransient, tMax},
   PlotStyle → myPlotStyle, PlotRange → myPlotRange,
   GridLines -> {Automatic, {-2, -1, 1, 2}}];
printInfo
GraphicsGrid[{{p1, p2}}]
```

$x' = f[x] + M \times H^T,\ f[u,v] = \{v, -u + 2\,(1 - u^2)\,v\},\ H = \begin{pmatrix} 0 & 0 \\ 1 & 0 \end{pmatrix}$

$\epsilon = 2,\ \kappa = 0.5,\ M = 0.5 \begin{pmatrix} 0 & 0 \\ 1. & 1. \end{pmatrix}$

x[0] = {{1.26956, -1.55432}, {1.1581, -1.24879}}

Out[•]=



Note: The same synchronized solution (with a phase shift) seems to be obtained for all random initial conditions. The figure was saved with a seed in the random number generator, SeedRandom[1], so oscillator 1 is always the same.

To save the figures, first use the “Insert file path” menu to point to a directory on your machine

In[•]:=
```
(*(SetDirectory[
  "C:\\Users\\jws8\\Dropbox\\Conjecture5.3\\Article\\Version 1\\"]*)
SetDirectory["/Users/jimswift/Dropbox/Conjecture5.3/Article/Version 1/"]
```

Out[•]= /Users/jimswift/Dropbox/Conjecture5.3/Article/Version 1

In[•]:=
```
If[ϵ == 2 && κ == -.5 && M == L, Export["vdpLnegk.pdf", p2, ImageSize → 250]
]
If[ϵ == 2 && κ == .5 && M == L, Export["vdpLposk.pdf", p2, ImageSize → 250]
]
If[ϵ == 2 && κ == -.5 && M == A, Export["vdpAnegk.pdf", p2, ImageSize → 250]
]
If[ϵ == 2 && κ == .5 && M == A, Export["vdpAposk.pdf", p2, ImageSize → 250]
]
```

Out[•]=
```
vdpAposk.pdf
```