```
dt = 0.001;
tmax = 20;
Nn = Evaluate[tmax / dt] // Round;
```

In[•]:=
```
tT = Table[i dt, {i, 0, Nn}];
```

In[•]:=
```
ξ1 = RandomVariate[NormalDistribution[0, √dt], Nn];
ξ2 = RandomVariate[NormalDistribution[0, √dt], Nn];
ξ3 = RandomVariate[NormalDistribution[0, √dt], Nn];
ξ4 = RandomVariate[NormalDistribution[0, √dt], Nn];
ξ5 = RandomVariate[NormalDistribution[0, √dt], Nn];
ξ6 = RandomVariate[NormalDistribution[0, √dt], Nn];
ξ7 = RandomVariate[NormalDistribution[0, √dt], Nn];
ξ8 = RandomVariate[NormalDistribution[0, √dt], Nn];
ξ9 = RandomVariate[NormalDistribution[0, √dt], Nn];
ξ10 = RandomVariate[NormalDistribution[0, √dt], Nn];
ξ11 = RandomVariate[NormalDistribution[0, √dt], Nn];
ξ12 = RandomVariate[NormalDistribution[0, √dt], Nn];
```

In[•]:=
```
x = ConstantArray[1, Nn + 1];
y = ConstantArray[1, Nn + 1];
z = ConstantArray[1, Nn + 1];
```

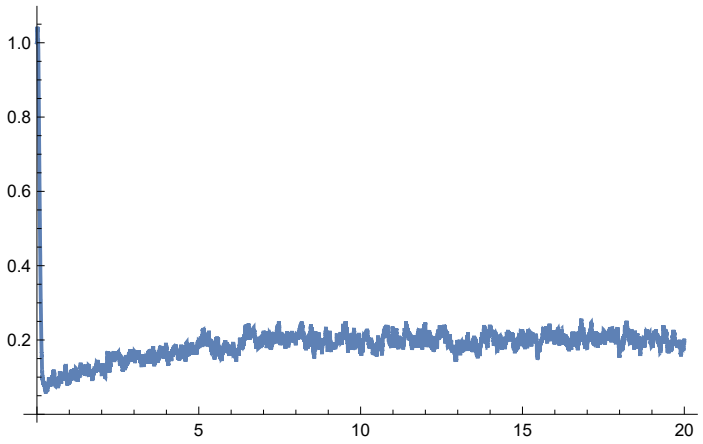
In[•]:=
```
V = 1000;
```

Steady State

In[•]:=
```
VvalsSS = {V0 → 2, V1 → 2 , V4 → 5, kf → 1, k → 10, β → 0.01, ϵ → 0.1 , VM2 → 6, k2 → 0.1,
    VM3 → 20, m → 2, kx → 0.5, ky → 0.2, kz → 0.2, VM5 → 30, k5 → 0.3, kd → 0.5, p → 2, n → 4};
For[i = 1, i ≤ Nn, i++,
x[[i + 1]] =
  (x[[i]] + (V0 + V1 β - k x[[i]] - VM2 x[[i]]^2 / (k2^2 + x[[i]]^2) + kf y[[i]] + VM3 x[[i]]^m y[[i]]^2 z[[i]]^4 / ((kx^m + x[[i]]^m) (ky^2 + y[[i]]^2) (kz^4 + z[[i]]^4))) *
    dt + 1/√V (√V0 ξ1[[i]] + √(V1 β) ξ2[[i]] - √(VM2 x[[i]]^2 / (k2^2 + x[[i]]^2)) ξ3[[i]] +
    √(VM3 x[[i]]^m / (kx^m + x[[i]]^m) y[[i]]^2 / (ky^2 + y[[i]]^2) z[[i]]^4 / (kz^4 + z[[i]]^4)) ξ4[[i]] +
    √(kf y[[i]]) ξ5[[i]] - √kx ξ6[[i]]) /. VvalsSS);
y[[i + 1]] = (y[[i]] + (VM2 x[[i]]^2 / (k2^2 + x[[i]]^2) - kf y[[i]] - VM3 x[[i]]^m y[[i]]^2 z[[i]]^4 / ((kx^m + x[[i]]^m) (ky^2 + y[[i]]^2) (kz^4 + z[[i]]^4))) dt + 1/√V
    (√(VM2 x[[i]]^2 / (k2^2 + x[[i]]^2)) ξ7[[i]] - √(VM3 x[[i]]^m / (kx^m + x[[i]]^m)) ξ8[[i]] - √(kf y[[i]]) ξ9[[i]]) /. VvalsSS);
z[[i + 1]] = (z[[i]] + (V4 β - ϵ z[[i]] - VM5 x[[i]]^n z[[i]]^p / ((kd^n + x[[i]]^n) (k5^p + z[[i]]^p))) dt + 1/√V (√(V4 β) ξ10[[i]] -
    √(VM5 z[[i]]^p / (k5^p + z[[i]]^p) x[[i]]^n / (kd^n + x[[i]]^n)) ξ11[[i]] - √(ϵ z[[i]]) ξ12[[i]]) /. VvalsSS);]
```

In[•]:=
```
ListLinePlot[Transpose[{tT, x}], PlotRange → All]
```

Out[•]=

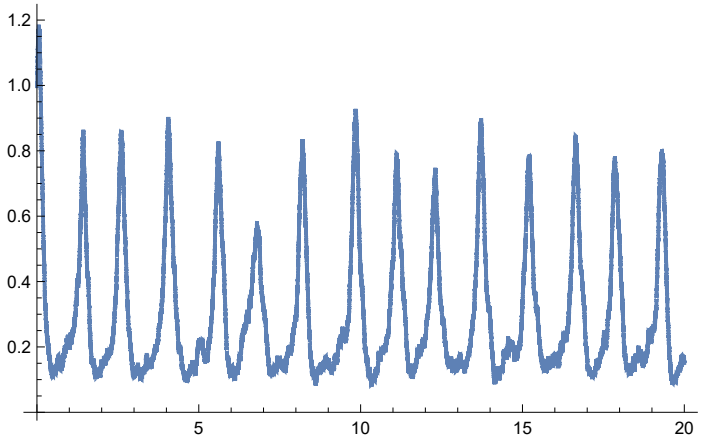


Simple Periodic Oscillations

In[•]:=
```
VvalsSPO = {V0 → 2, V1 → 2 , V4 → 2, kf → 1, k → 10, β → 0.5, ϵ → 0.1 , VM2 → 6, k2 → 0.1,
    VM3 → 20, m → 2, kx → 0.5, ky → 0.2, kz → 0.2, VM5 → 5, k5 → 1, kd → 0.4, p → 2, n → 4};
For[i = 1, i ≤ Nn, i++,
x[[i + 1]] =
  (x[[i]] + (V0 + V1 β - k x[[i]] - VM2 x[[i]]^2 / (k2^2 + x[[i]]^2) + kf y[[i]] +
     VM3 x[[i]]^m y[[i]]^2 z[[i]]^4 / ((kx^m + x[[i]]^m) (ky^2 + y[[i]]^2) (kz^4 + z[[i]]^4))) *
    dt + 1/√V (√V0 ξ1[[i]] + √(V1 β) ξ2[[i]] - √(VM2 x[[i]]^2 / (k2^2 + x[[i]]^2)) ξ3[[i]] +
    √(VM3 x[[i]]^m / (kx^m + x[[i]]^m) y[[i]]^2 / (ky^2 + y[[i]]^2) z[[i]]^4 / (kz^4 + z[[i]]^4)) ξ4[[i]] +
    √(kf y[[i]]) ξ5[[i]] - √kx ξ6[[i]]) /. VvalsSPO);
y[[i + 1]] = (y[[i]] + (VM2 x[[i]]^2 / (k2^2 + x[[i]]^2) - kf y[[i]] -
    VM3 x[[i]]^m y[[i]]^2 z[[i]]^4 / ((kx^m + x[[i]]^m) (ky^2 + y[[i]]^2) (kz^4 + z[[i]]^4))) dt +
  1/√V (√(VM2 x[[i]]^2 / (k2^2 + x[[i]]^2)) ξ7[[i]] - √(VM3 x[[i]]^m / (kx^m + x[[i]]^m)) ξ8[[i]] -
    √(kf y[[i]]) ξ9[[i]]) /. VvalsSPO);
z[[i + 1]] = (z[[i]] + (V4 β - ϵ z[[i]] - VM5 x[[i]]^n z[[i]]^p / ((kd^n + x[[i]]^n) (k5^p + z[[i]]^p))) dt +
  1/√V (√(V4 β) ξ10[[i]] - √(VM5 z[[i]]^p / (k5^p + z[[i]]^p) x[[i]]^n / (kd^n + x[[i]]^n)) ξ11[[i]] -
    √(ϵ z[[i]]) ξ12[[i]]) /. VvalsSPO);]
```

In[•]:=
```
ListLinePlot[Transpose[{tT, x}], PlotRange → All]
```

Out[•]=

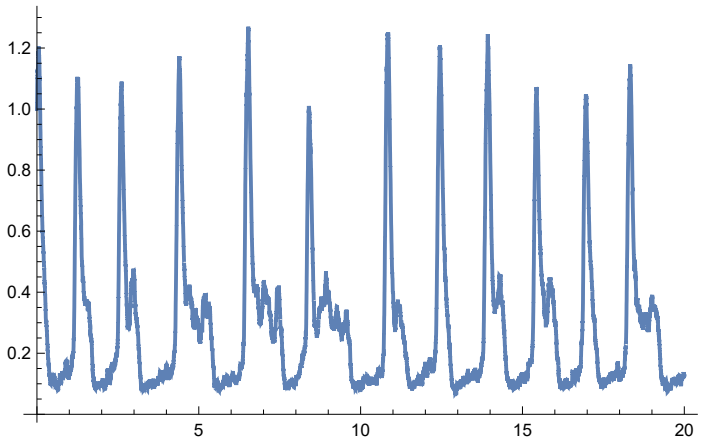


Bursting

In[•]:=
```
VvalsB = {V0 → 2, V1 → 2 , V4 → 2.5, kf → 1, k → 10, β → 0.46, ϵ → 0.1 , VM2 → 6, k2 → 0.1,
    VM3 → 20, m → 4, kx → 0.3, ky → 0.2, kz → 0.1, VM5 → 30, k5 → 1, kd → 0.6, p → 1, n → 2};
For[i = 1, i ≤ Nn, i++,
x[[i + 1]] =
  (x[[i]] + (V0 + V1 β - k x[[i]] - VM2 x[[i]]^2 / (k2^2 + x[[i]]^2) + kf y[[i]] + VM3 x[[i]]^m y[[i]]^2 z[[i]]^4 / ((kx^m + x[[i]]^m) (ky^2 + y[[i]]^2) (kz^4 + z[[i]]^4))) *
    dt + 1/√V (√V0 ξ1[[i]] + √(V1 β) ξ2[[i]] - √(VM2 x[[i]]^2 / (k2^2 + x[[i]]^2)) ξ3[[i]] +
    √(VM3 x[[i]]^m / (kx^m + x[[i]]^m) y[[i]]^2 / (ky^2 + y[[i]]^2) z[[i]]^4 / (kz^4 + z[[i]]^4)) ξ4[[i]] +
    √(kf y[[i]]) ξ5[[i]] - √kx ξ6[[i]]) /. VvalsB);
y[[i + 1]] = (y[[i]] + (VM2 x[[i]]^2 / (k2^2 + x[[i]]^2) - kf y[[i]] - VM3 x[[i]]^m y[[i]]^2 z[[i]]^4 / ((kx^m + x[[i]]^m) (ky^2 + y[[i]]^2) (kz^4 + z[[i]]^4))) dt +
    1/√V (√(VM2 x[[i]]^2 / (k2^2 + x[[i]]^2)) ξ7[[i]] - √(VM3 x[[i]]^m / (kx^m + x[[i]]^m)) ξ8[[i]] - √(kf y[[i]]) ξ9[[i]]) /. VvalsB);
z[[i + 1]] = (z[[i]] + (V4 β - ϵ z[[i]] - VM5 x[[i]]^n z[[i]]^p / ((kd^n + x[[i]]^n) (k5^p + z[[i]]^p))) dt + 1/√V (√(V4 β) ξ10[[i]] -
    √(VM5 z[[i]]^p / (k5^p + z[[i]]^p) x[[i]]^n / (kd^n + x[[i]]^n)) ξ11[[i]] - √(ϵ z[[i]]) ξ12[[i]]) /. VvalsB);]
```

In[•]:=
```
ListLinePlot[Transpose[{tT, x}], PlotRange → All]
```

Out[•]=

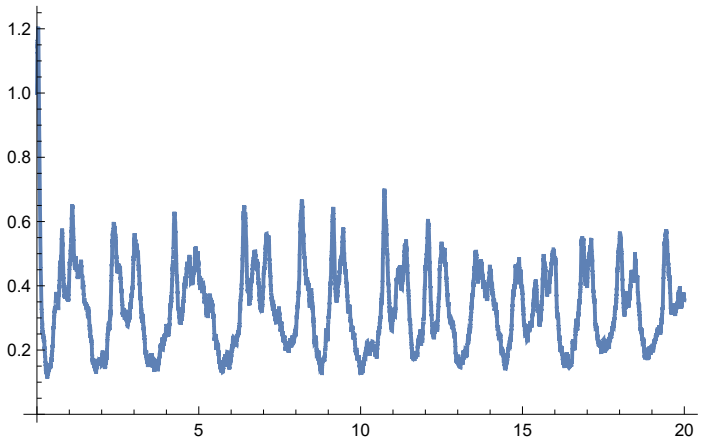


Chaos

In[•]:=
```
VvalsC = {V0 → 2, V1 → 2 , V4 → 3, kf → 1, k → 10, β → 0.65, ϵ → 13 , VM2 → 6, k2 → 0.1, VM3 → 30,
    m → 2, kx → 0.6, ky → 0.3, kz → 0.1, VM5 → 50, k5 → 0.3194, kd → 1, p → 1, n → 4};
For[i = 1, i ≤ Nn, i++,
x[[i + 1]] =
  (x[[i]] + (V0 + V1 β - k x[[i]] - VM2 x[[i]]^2 / (k2^2 + x[[i]]^2) + kf y[[i]] + VM3 x[[i]]^m y[[i]]^2 z[[i]]^4 / ((kx^m + x[[i]]^m) (ky^2 + y[[i]]^2) (kz^4 + z[[i]]^4))) *
    dt + 1/√V (√V0 ξ1[[i]] + √(V1 β) ξ2[[i]] - √(VM2 x[[i]]^2 / (k2^2 + x[[i]]^2)) ξ3[[i]] +
    √(VM3 x[[i]]^m / (kx^m + x[[i]]^m) y[[i]]^2 / (ky^2 + y[[i]]^2) z[[i]]^4 / (kz^4 + z[[i]]^4)) ξ4[[i]] +
    √(kf y[[i]]) ξ5[[i]] - √kx ξ6[[i]]) /. VvalsC];
y[[i + 1]] = (y[[i]] + (VM2 x[[i]]^2 / (k2^2 + x[[i]]^2) - kf y[[i]] - VM3 x[[i]]^m y[[i]]^2 z[[i]]^4 / ((kx^m + x[[i]]^m) (ky^2 + y[[i]]^2) (kz^4 + z[[i]]^4))) dt +
  1/√V (√(VM2 x[[i]]^2 / (k2^2 + x[[i]]^2)) ξ7[[i]] - √(VM3 x[[i]]^m / (kx^m + x[[i]]^m)) ξ8[[i]] - √(kf y[[i]]) ξ9[[i]]) /. VvalsC];
z[[i + 1]] = (z[[i]] + (V4 β - ϵ z[[i]] - VM5 x[[i]]^n z[[i]]^p / ((kd^n + x[[i]]^n) (k5^p + z[[i]]^p))) dt + 1/√V
  (√(V4 β) ξ10[[i]] - √(VM5 z[[i]]^p / (k5^p + z[[i]]^p) x[[i]]^n / (kd^n + x[[i]]^n)) ξ11[[i]] - √(ϵ z[[i]]) ξ12[[i]]) /. VvalsC];]
```

In[•]:=
```
ListLinePlot[Transpose[{tT, x}], PlotRange → All]
```

Out[•]=



Period Doubling Sequences

In[•]:=
```
VvalsPDS = {V0 → 2, V1 → 2 , V4 → 3, kf → 1, k → 10, β → 0.7, ϵ → 13 , VM2 → 6, k2 → 0.1,
    VM3 → 30, m → 2, kx → 0.6, ky → 0.3, kz → 0.1, VM5 → 50, k5 → 0.3194, kd → 1, p → 1, n → 4};
For[i = 1, i ≤ Nn, i++,
x[[i + 1]] =
  (x[[i]] + (V0 + V1 β - k x[[i]] - VM2 x[[i]]^2 / (k2^2 + x[[i]]^2) + kf y[[i]] + VM3 x[[i]]^m y[[i]]^2 z[[i]]^4 / ((kx^m + x[[i]]^m) (ky^2 + y[[i]]^2) (kz^4 + z[[i]]^4))) *
    dt + 1/√V (√V0 ξ1[[i]] + √(V1 β) ξ2[[i]] - √(VM2 x[[i]]^2 / (k2^2 + x[[i]]^2)) ξ3[[i]] +
    √(VM3 x[[i]]^m / (kx^m + x[[i]]^m) y[[i]]^2 / (ky^2 + y[[i]]^2) z[[i]]^4 / (kz^4 + z[[i]]^4)) ξ4[[i]] +
    √(kf y[[i]]) ξ5[[i]] - √kx ξ6[[i]]) /. VvalsPDS);
y[[i + 1]] = (y[[i]] + (VM2 x[[i]]^2 / (k2^2 + x[[i]]^2) - kf y[[i]] - VM3 x[[i]]^m y[[i]]^2 z[[i]]^4 / ((kx^m + x[[i]]^m) (ky^2 + y[[i]]^2) (kz^4 + z[[i]]^4))) dt + 1/√V
    (√(VM2 x[[i]]^2 / (k2^2 + x[[i]]^2)) ξ7[[i]] - √(VM3 x[[i]]^m / (kx^m + x[[i]]^m)) ξ8[[i]] - √(kf y[[i]]) ξ9[[i]]) /. VvalsPDS);
z[[i + 1]] = (z[[i]] + (V4 β - ϵ z[[i]] - VM5 x[[i]]^n z[[i]]^p / ((kd^n + x[[i]]^n) (k5^p + z[[i]]^p))) dt + 1/√V (√(V4 β) ξ10[[i]] -
    √(VM5 z[[i]]^p / (k5^p + z[[i]]^p) x[[i]]^n / (kd^n + x[[i]]^n)) ξ11[[i]] - √(ϵ z[[i]]) ξ12[[i]]) /. VvalsPDS);]
```

In[•]:=
```
ListLinePlot[Transpose[{tT, x}], PlotRange → All]
```

Out[•]=