Lorenz Attractor

The Lorenz system is a well known example of deterministic chaos in a simple set of 3 ordinary differential equations. This example illustrates the use of 3D visualization in understanding the phase plane dynamics of a simple nonlinear system.

$$\frac{dx}{dt} = \sigma(y - x)$$

$$\frac{dy}{dt} =$$

$$\frac{dz}{dt} =$$

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Dependencies

This example uses the Chebfun package.

Parameters

```
sig=10;
beta=8/3;
rho=28;
```

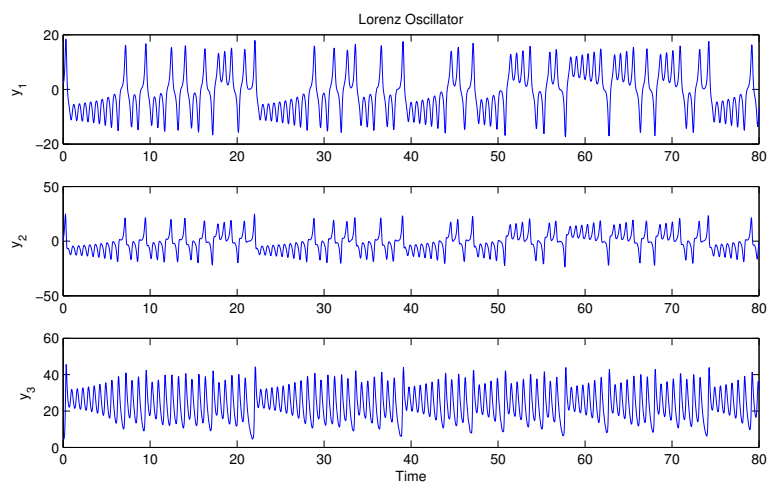## Model Equations

```
deriv = @(t,x) [ ...
    -sig*x(1) + sig*x(2); ...
    rho*x(1) - x(2) - x(1)*x(3); ...
    -beta*x(3) + x(1)*x(2)];
```

Simulation

```
y = ode45(deriv,domain(0,80),[3 0 5]);

figure(1);clf;
subplot(3,1,1); plot(y(:,1)); ylabel('y_1');
title('Lorenz Oscillator');
subplot(3,1,2); plot(y(:,2)); ylabel('y_2');
subplot(3,1,3); plot(y(:,3)); ylabel('y_3');
xlabel('Time');
```


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```
figure(2);clf;
plot3(y(:,1),y(:,2),y(:,3));
grid
title('Lorenz Oscillator');
xlabel('y_1');ylabel('y_2');zlabel('y_3');
```

Lorenz Oscillator