The Lorenz Equations

My Solutions ›

The Lorenz equations are a system of nonlinear odes that pioneered the study of chaos. The Lorenz equations are given by

$$\dot{x} = \sigma(y - x), \qquad \dot{y} = x(r - z) - y, \qquad \dot{z} = xy - \beta z,$$

where σ, β and r are constants. Edward Lorenz studied the solution for $\sigma = 10$, $\beta = 8/3$ and $r = 28$, and the result is now known as the Lorenz attractor, an example of what is now more generally known as a strange attractor.

Compute the Lorenz attractor and plot z versus x and y. Remove the transient before plotting.

Show the reference solution for this problem

Script

Reference Solution | Save | Reset | MATLAB Documentation (https://www.mathworks.com/help/)

```
sigma=10; beta=8/3; r=28;
x0=1; y0=1; z0=1; tspan=[0 100];
ntrans=20;
options = odeset('RelTol',1.e-6);
[t,xyz]=ode45(@(t, xyz) lorenz_eqs(xyz, sigma, beta, r), tspan, [x0, y0, z0], options);
x=xyz(ntrans:end,1); y=xyz(ntrans:end,2); z=xyz(ntrans:end,3);
plot3(x,y,z);
xlabel('$x$','Interpreter','latex','FontSize',14 );
ylabel('$y$','Interpreter','latex','FontSize',14 );
zlabel('$z$','Interpreter','latex','FontSize',14 );
title('Lorenz Equations','Interpreter','latex','FontSize',16);

function dxyzdt = lorenz_eqs(xyz,sigma,beta,r)
x=xyz(1); y=xyz(2); z=xyz(3);
dxyzdt=[sigma*(y-x); x*(r-z)-y; x*y-beta*z];
end

```

Run Script

Assessment: All Tests Passed

Submit

- Test x.
- Test y.
- Test z.

Output