Fixed-Point Solutions of the Lorenz Equations

My Solutions ›

Complete a MATLAB code that uses Newton's method to determine fixed-point folutions of the Lorenz equations. Solve using the parameters $r = 28$, $\sigma = 10$ and $\beta = 8/3$. Use as your three initial guesses $x = y = z = 1$, $x = y = z = 10$ and $x = y = z = -10$.

Script

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

```
r=28; sigma=10; b=8/3;
RelTol=1.e-06; AbsTol=1.e-09;
for nroot=1:3
    if nroot==1, x=1; y=1; z=1; end
    if nroot==2, x=10; y=10; z=10; end
    if nroot==3, x=-10; y=-10; z=-10; end
    error=Inf;
    while error > max(RelTol*max(abs([x,y,z])),AbsTol)
        J=  [-sigma sigma 0; r-z -1 -x; y x -b];   % DEFINE THE JACOBIAN MATRIX
        rhs = -[sigma*(y-x); x*(r-z)-y; x*y-b*z]; % DEFINE THE RIGHT-HAND SIDE
        delta_xyz=J\rhs;
        x = x + delta_xyz(1);
        y = y + delta_xyz(2);
        z = z + delta_xyz(3);
        error=max(abs(delta_xyz));
    end
    xroot(nroot)=x; yroot(nroot)=y; zroot(nroot)=z;
end
roots=[xroot;yroot;zroot];
fprintf('steady-state solution:\n')
fprintf('(x, y, z) = (%2.0f,%2.0f,%2.0f)  \n', roots(:,1));
fprintf('(x, y, z) = (%7.5f,%7.5f,%3.0f)  \n', roots(:,2));
fprintf('(x, y, z) = (%7.5f,%7.5f,%3.0f)  \n', roots(:,3));

```

▶ Run Script

Assessment: All Tests Passed

Submit

✔ **Test for the correct fixed-point solutions**

Output

```
steady-state solution:
(x, y, z) = ( 0, 0,-0)
(x, y, z) = (8.48528,8.48528, 27)
(x, y, z) = (-8.48528,-8.48528, 27)
```