Problem: Discrete Display

Discrete Systems

0.0/20.0 points (graded)

For a univariate dynamic system $\dot{x} = f(x)$ we have seen via graphical analysis that x^* is a locally stable equilibrium if the following conditions hold

1. $f(x^*) = 0$
2. $\frac{\partial f}{\partial x}(x^*) < 0$

Otherwise stated, that $f(x)$ has a zero-crossing at x^* with negative slope.

Now, consider a simple discretization of this continuous system, where for some fixed time step h we have:

$$x[k+1] = x[k] + hf(x[k])$$

For arbitrary h, the two conditions above are *not* sufficient for stability of the discrete system. Provide a counterexample demonstrating this by giving values for x_star, $f(x)$, and h below.

```
1 syms x
2 x_star =
3 h =
4 f =
5
```

Unanswered

Run Code

Find the upper bound h^* such that all $h < h^*$ results in a stable discrete system. Write your answer in terms of G, where $G = \left|\frac{\partial f}{\partial x}(x^*)\right| > 0$

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