3.5.3 Finger Exercise: Equilibrium conditions for a nonlinear scalar IVP

Finger Exercises 3 due Aug 17, 2023 05:00 IST Completed

Problem: Determine equilibrium conditions using Newton-Raphson method

3.0/3.0 points (graded)

Consider an Initial Value Problem governed by the following nonlinear equation

$$\frac{\mathrm{d}u}{\mathrm{d}t} = f(u) \tag{3.25}$$

with

$$f(u) = -\sin(2\pi u)\exp(-u) \tag{3.26}$$

A plot of $f(u)$ is given in Figure 3.1.

Figure 3.1: Plot of $f(u) = -\sin(2\pi u)\exp(-u)$

Suppose we apply the Newton-Raphson method to find an equilibrium condition for which $f(u_{\mathrm{eq}}) = 0$. If the initial guess of the Newton-Raphson method is $u = 0.4$, what value of u will the Newton-Raphson method converge to:

0.5 ✔ Answer: 0.5

Suppose the initial guess of the Newton-Raphson method is $u = 0.6$, what value of u will the Newton-Raphson method converge to:

0.5 ✔ Answer: 0.5

Finally, suppose the initial guess of the Newton-Raphson method is $u = 0.9$, what value of u will the Newton-Raphson method converge to:

1.0 ✔ Answer: 1.0

Solution:

Note: this video contains the solution to all parts of this Finger Exercise.

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