Patrick Ørsted Povey Andersen

Mandatory Exercise 2

Numeriske metoder

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Multi-dimensional root finding task

Task

You are ordering cables, each with a resting length, L0, to be between pylons that are d = 30 meters apart. Ideally, you would like no "sagging", n = 0, but that would cause infinite string tension in the cable, so you need to choose a compromise between sagging and tension.

To inform the decision, you:
Determine L0 and (H) for n = 5.0, n = 2.0, n = 1.0, n = 0.5, n = 0.2, and n = 0.1

Solution

I create a class called CableFunc that defines the system of equations that describe the physical setup.

CableFunc provides the function F(g) that newt needs to solve F(g) = 0. Each call to vecfunc(q) computes the residuals based on the current values in q.

To solve the task, i start out with a starting guess for n = 5 and look at the values that are computed. Using the computed values from n = 5 i make a new guess for n = 2 and repeat this process for the remaining n values.

Workflow

1. Main sets up an initial guess q and instantiates vecfunc.
2. newt iteratively calls vecfunc(q), computes residuals, approximates the Jacobian, and updates q.
3. When converged, contains the solution, which main prints.

Full Terminal Solution

```
patrickandersen@Patricks-MacBook-Pro man2 % "/Users/patrickandersen/Desktop/6 semester/Numeriske Metoder/Code/build/man2/man2"

n = 5: L0 = 27.5233, L = 27.524, p = 3.20646, x = 13.2584, theta = 0.800085, phi = 0.457821, a = 27.9297, H = 124.541
n = 2: L0 = 25.4565, L = 25.458, p = 1.10775, x = 12.6646, theta = 0.364947, phi = 0.173614, a = 72.5797, H = 294.733
n = 1: L0 = 25.114, L = 25.117, p = 0.537568, x = 12.5431, theta = 0.186044, phi = 0.085558, a = 146.425, H = 587.781
n = 0.5: L0 = 25.0235, L = 25.0294, p = 0.266656, x = 12.5109, theta = 0.0934738, phi = 0.0426083, a = 293.537, H = 1174.94
n = 0.2: L0 = 24.99, L = 25.0047, p = 0.106413, x = 12.5018, theta = 0.0374436, phi = 0.0170224, a = 734.392, H = 2936.27
n = 0.1: L0 = 24.9719, L = 25.0012, p = 0.0531813, x = 12.5004, theta = 0.0187286, phi = 0.00850855, a = 1469.14, H = 5869.9
```