5DV005, Fall 2018, Lab session 4

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Contents

1 The time and the place

The lab session will take place on

Wednesday, November 28th, 2018, (kl. 13.00-16.00), Room MA416-426.

2 The problems

It is a smashing idea to check the folder `lab4/scripts` carefully!

Problem 1

1. Develop a function `MySinh` which computes the function

$$f(x) = \frac{e^x - e^{-x}}{2}.$$

   You may use the built-in function `exp` to evaluate e^x when $|x|$ is sufficiently large, but you must rewrite f to avoid the subtractive cancellation at when $x \approx 0$.

2. Develop a minimal working example `MySinhMWE` which compares your implementation to the built-in function `sinh`. It is possible to reduce the relative error below 10^{-15} on the interval $[-3, 3]$.

Problem 2

1. Develop a function `MyNewtonSqrt` which uses Newton's method for computing square roots subject. Your function must use the initial guess

$$x_0(s) = \frac{1}{3}s + \frac{17}{24}$$

   for $\sqrt{s}$ when $s \in [1, 4]$.

2. Develop a minimal working example `MyNewtonSqrtMWE1` which compares your implementation to the built in function `sqrt`. It is possible to reduce the relative error to $2u$ on the interval $[10^{-3}, 10^{3}]$.

Problem 3

1. Develop a function `MyLog` which uses Newton's method to solve the non-linear equation $f(x) = 0$ where $f(x) = \exp(x) - \alpha$ and $\alpha > 0$. Your function must exploit the fact that if $\alpha = f \cdot 2^e$, then

$$\log(\alpha) = \log(f) + e\log(2)$$

   Your are free to use the special function `log2` to determine f and e. You are free to use the built-in value of $\log(2)$. Your function must use the initial guess

$$x_0(s) = as + b, \qquad a = \log(2), \qquad b = -\frac{a + \log(a) + 1}{2}$$

   for $\log(s)$ when $s \in [1, 2]$.

2. Develop a minimal working example `MyLogMWE` which compares your implementation to the built-in function `log`. It is possible to reduce the relative error below $2u$ on the interval $[2, 10]$.

Problem 4

1. Copy the script `scripts/l4p4.m` into the function `work/MyRobustSecant.m` and complete the function according to the specification.

2. Develop a minimal working example `MyRobustSecantMWE` which solves the your favorite non-linear equation. I recommend computing a firing solution.