Technische Universität Braunschweig
Institute for Partial Differential Equations
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Numerical Methods for Differential Equations

Assignment 3

Upload solutions until 16 May 2022, 3pm

Exercise 3.1 (Trapezoidal rule) (10 points)

Write a function file (a ".m"-file) `trapez.m`, which calculates the approximate value $Q(f)$ of the integral $\int_a^b f(x)\,\mathrm{d}x$ using the trapezoidal rule when entering a function f and the boundary values of an interval $[a, b]$.

Now, write a script in `Matlab` that calculates the integral of the function $f(x) = \exp(x)$ on the interval $[0, 1]$ using the `Matlab` function file you have just created. Compute the same integral using the following two commands in `Matlab`: `q=integral(f,a,b)` and `q=trapz(x,y)`. Compare the three values with the analytical value. What do you observe? Make a comment in the script file.

Exercise 3.2 (Summed trapezoidal rule) (10 points)

Based on the above written `Matlab` function file for the trapezoidal rule, create another `Matlab` function that subdivides $[a, b]$ into equidistant subintervals and applies the trapezoidal rule to every subinterval. The function now takes the number of subintervals J also as input along with the previous three inputs.
As in Exercise 3.1, compute for the same function f the integral on the interval $[0, 1]$ using trapezoidal rule for values of $J = [10, 20, ...100]$. What do you observe? Make a comment in the script file.

Hint: The `nargin` command in `Matlab` can be used to execute different codes based on the number of inputs given. You can use this to avoid creating a new function file for Exercise 3.2 and use a single function file for both the tasks.