

Course Project Report: Advanced Math Analysis with Matlab

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Abstract

The report for the end-of-term project of Advanced Math Analysis with MATLAB fall 2021 course. All the source code is open-sourced on the Github repository <https://github.com/SmartPolarBear/matlab-math-analysis-csxmu-2021> under **GPLv3** license

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1 Problem 1

1.1 Problem Description

Given function $F(x, y) = 0.2x^2 + 0.1y^2 + \sin(x + y)$, please work out its gradient. Based on the gradient, please find out the local extreme of function $F(x, y)$ when both x and y are in the range of $[-2 * \pi, 2 * \pi]$. The 2D and 3D views of the function is given in Fig. 1.

1.2 Solution

1.2.1 The gradient of the function

I get the gradient of the function using the following code

```
1     syms x y;  
2     f=0.2*x^2+0.1*y^2+sin(x+y);  
3     diff(f,x)  
4     diff(f,y)
```

Based on the result, the gradient is

$$\nabla \cdot f(x, y) = \left(\frac{2 * x}{5} + \cos(x + y), \frac{y}{5} + \cos(x + y) \right) \quad (1)$$

1.2.2 Find the extreme values

To find the extreme values of $F(x, y)$ with gradient decent method, we walk little steps towards the direction of the gradient. To formalize this idea, the algorithm is shown as follows.

1.3 Acknowledgment

Thanks to (TODO)