**EGR 103L – Spring 2020**

**Laboratory 8 - Surfaces**

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Lab Section 6, Thursday 3:05-5:55 PM

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I understand and have adhered to all the tenets of the Duke Community Standard in completing every part of this assignment. I understand that a violation of any part of the Standard on any part of this assignment can result in failure of this assignment, failure of this course, and/or suspension from Duke University.

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## 1 Chapra 2.22

When looking at the output plots for this problem, I noticed that the top graph (red spiral) appears smooth towards the center of the spiral but gradually appears more rigid as it moves outward. In addition, the bottom graph (cyan cone) is more smooth towards the bottom but the circles towards the top of the graph are more rigid and less circle-like. A reason for this could be because while the magnitude of each t increment is not changing, the area that the x and y variables must cover in each circular cross-section increases as t increases. This results in the same amount of vertex points for each cross-section, making each circle more rigid and less-circular as the cone figure moves from bottom to top.

## 2 Chapra 3.9

Increasing the depth (H) results in an increase in velocity, displaying a shape that is similar to the top half of a sideways parabola. Increasing the width (B) also results in an increase in velocity with a similar shape to the top half of a sideways parabola, but the rate of growth is less in this parabola than in the increase of depth. In other words, a unit increase of depth holding width constant results in a smaller increase in velocity than a unit increase of width holding depth constant.

## 3 Chapra 15.5

Increasing the temperature while holding chloride concentration constant results in a decrease in oxygen concentration that appears relatively linear. Increasing the chloride concentration while holding the temperature also results in a relatively linear decrease in oxygen concentration with a lower rate of change when compared to the temperature vs oxygen concentration relationship.

## 4 Chapra 15.6

Using a planar model:

the model coefficients and other required values are:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  |  | g/ml |  |
| 1.3522e+01 | -1.0493e-01 | -2.0124e-01 | 9.533 | 4.88% |

The error function looks like a paraboloid that relates Oxygen concentration to temperature, as chloride concentration does not have an apparent bearing on the function. A parabolic function that relates OC and T would resemble this error function, like OC = (T)2 + constant.

## 5 Chapra 15.7

Using a first-order model for and a third-order model for :

the model coefficients and other required values are:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | g/ml |  |
| 1.4027e+01 | -1.0493e-01 | -4.3704e-05 | 5.7444e-03 | -3.3642e-01 | 9.168 | 0.856% |

The error function looks like a hyperbolic paraboloid or a saddle. A function that would resemble the error function would be some configuration of the base function OC = (T)2 – (c)2.

## 6 Sphere

Transformation equations:

x = ρ sin(φ) cos(θ)

y = ρ sin(φ) sin(θ)

z = ρ cos(φ)