**Project 1: Dispersion of fifth order stokes waves**

In order to estimate the design loads for an offshore structure, two parameters – wavelength (L) and the amplitude parameter (a) of gravity waves were used in this project. These two parameters are obtained by solving two coupled nonlinear fifth order stokes equations.

*(1)*

*(2)*

Where

Given Parameters: water depth (d) = 9 m, Wave period (T) = 7 sec, Crest to trough height (H) = 5.67 m.

Initial Guesses (L0,a0) = (60, 2.5)

**Algorithm for R Programming:**

We rewrite the given two equations in 1 and 2 in the form of

*(3)*

*(4)*

Here L and a are two unknowns which is represented in the form of vector x[1] and x[2]. The solution is calculated by the Newton Rapson Method in two variables.

We follow the algorithm of Dr. Bhattacharya where he expanded the equation 3 and 4 by Taylor series expansion about values of x[1] and x[2] in kth iteration. This expansion gives set of two linear equations in e1 and e2 which can be written as:

}

Where, is the Jacobian of the system which we calculated using inbuilt Jacobian function of R and is given by:

So, the solution is given by,

}

Finally use the following equation for doing iteration and provided the Initial Guesses (L0,a0) = (60, 2.5)

(x[1]k+1 , x[2]k+1) = (x[1]k , x[2]k) }

We stop the iterative calculation when we get the values at the consecutive iteration is less than the tolerance which is specified initially.

Finally, I got following result from the program.

The solution comes in 4 iterations the results are 66.6697 , 2.35207

So, the value of wavelength, L = 66.67 m and amplitude, a is 2.35 m.