The University of Windsor

ELEC2250: Physical Electronics

Summer 2020

Lab 2

1D and 2D Wave Function Simulation in MATLAB

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Five MATLAB functions used in the script

List of 5 MATLAB functions and their descriptions:

i)   linespace(x1, x2, n); takes points x1 and x2 and creates an array of n values evenly

spaced between x1 and x2

ii)   sin(x); returns the sin value at x where x can either be a numerical value or an array of

numerical values

iii)   length(x); returns and integer value for the size of an array

iv)   plot(x, y); plots the values of x and y where x or y can be a function. If either x or y is

a function, the other variable must be a value or array of values that can be plotted

onto a 2D plan.

v)   rgb2ind(); converts an RGB image of 3d matrix to an index matrix

Part A Notes

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5 Energy Levels (n = 1:1:5) with Quantum Well Length (x = 1E-6):

Final Energy: 1.5079E-24 J; Control Value

Final Particle Velocity: 1819.4 m/s; Control Value

Peak Amplitude: 1414.2; Control Value

5 Energy Levels (n = 1:1:5) with Doubled Quantum Well Length (x = 2E-6):

Final Energy: 3.7696E-25 J; The energy decreased with an increase in length

Final Particle Velocity: 909.7146 m/s; velocity decreased with an increase in length

Peak Amplitude: 1000; The amplitude decreased with an increase in length

5 Energy Levels (n = 1:1:5) with Halved Quantum Well Length (x = 0.5E-6):

Final Energy: 6.0314E-24 J; The energy increased with a decrease in length

Final Particle Velocity: 3637.9 m/s; Velocity increased with a decrease in length

Peak Amplitude: 2000; The amplitude increased with a decrease in length

Essentially all parameters increased with decreased quantum well length

Part B Notes

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5 Energy Levels (n = 1:1:5) with Quantum Well Length (kx, yx = 1E-6):

Final Energy: 3.0157E-24 J; Control Value

Final Particle Velocity: 2573.1 m/s; Control Value

Peak Amplitude: 2E6; Control Value

5 Energy Levels (n = 1:1:5) with Doubled Quantum Well Lengths (kx, yx = 2E-6):

Final Energy: 7.5383E-25 J; The energy decreased with an increase in length

Final Particle Velocity: 1286.5 m/s; Velocity decreased with an increase in length

Peak Amplitude: 1E6; The amplitude decreased with an increase in length

5 Energy Levels (n = 1:1:5) with Halved Quantum Well Lengths (kx, yx = 0.5E-6):

Final Energy: 1.2063E-23 J; The energy increased with a decrease in length

Final Particle Velocity m/s: 5146.1; Velocity increased with a decrease in length

Peak Amplitude: 4E6; The amplitude increased with a decrease in length

Like in Part A, all parameters increased with decreased quantum well lengths