

## LIST OF FIGURE

2.1	The basic elements of a GPR system: 1, controller; 2, transmitter antenna; 3, receiver antenna; 4 and 5, laptop for data storage and monitoring; and 6, encoder wheel for distance measurement [1]. . . . .	5
2.2	GPR System Signal Modelling. . . . .	6
2.3	Schema A-scan. . . . .	7
2.4	A-scan Signal. . . . .	7
2.5	Schema B-scan. . . . .	9
2.6	B-scan Signal. . . . .	9
2.7	Schema C-scan. . . . .	10
2.8	GPR Modelling Using VNA. . . . .	11
2.9	Resoluiton for GPR. . . . .	13
2.10	A pulse width in each pulse a) Monocycle b) Gaussian c) Ricker wavelet . . . . .	14
2.11	Monocycle Pulse. . . . .	15
2.12	Gaussian Pulse. . . . .	15
2.13	Ricker Wavelet. . . . .	16
3.1	Framework for This Undergraduate Thesis . . . . .	17
3.2	The 3D Design of The Sandbox . . . . .	18
3.3	B-scan Scanning Schema . . . . .	19
3.4	Calibration . . . . .	20
3.5	One Point A-scan . . . . .	21
3.6	One Point B-scan . . . . .	22
4.1	B-scan with pulse width 0.585% duty cycle a) Monocycle b) Gaussian c) Ricker wavelet . . . . .	24
4.2	B-scan with pulse width 3.42% duty cycle a) Monocycle b) Gaussian c) Ricker wavelet . . . . .	26
4.3	B-scan with pulse width 9.52% duty cycle a) Monocycle b) Gaussian c) Ricker wavelet . . . . .	27
4.4	B-scan using Monocycle for different pulse width a) 0.585% duty cycle b) 3.42% duty cycle c) 9.52% duty cycle . . . . .	28

4.5	B-scan using Gaussian for different pulse width a) 0.585% duty cycle b) 3.42% duty cycle c) 9.52% duty cycle . . . . .	30
4.6	B-scan using Ricker wavelet for different pulse width a) 0.585% duty cycle b) 3.42% duty cycle c) 9.52% duty cycle . . . . .	31