

## TABLE OF CONTENTS

<b>LIST OF PUBLICATIONS .....</b>	<b>XVI</b>
<b>ABSTRACT.....</b>	<b>XVII</b>
<b>CHAPTER 1.....</b>	<b>XV</b>
<b>INTRODUCTION.....</b>	<b>1</b>
1.1 OBJECTIVES .....	2
1.2 THESIS ORGANIZATION .....	2
<b>CHAPTER 2.....</b>	<b>4</b>
<b>BACKGROUND AND LITERATURE REVIEW .....</b>	<b>4</b>
2.1 LITERATURE REVIEW.....	10
2.2 NEED FOR SOME NEW METHOD/MODEL.....	16
2.3 REFERENCES.....	16
<b>CHAPTER 3 .....</b>	<b>23</b>
<b>MONTE CARLO TECHNIQUES .....</b>	<b>23</b>
3.1 ESSENTIALS OF MONTE CARLO SIMULATION .....	23
3.1.1 <i>The Evaluation of Random Processes</i> .....	25
3.2 GAMMA RAY DETECTOR EFFICIENCY BY MONTE CARLO METHOD.....	27
3.3 MATLAB .....	28
3.3.1 <i>The MATLAB System</i> .....	29
3.3.2 <i>Development Environment and Desktop Tools</i> .....	29
3.3.3 <i>The MATLAB Mathematical Function Library</i> .....	29
3.3.4 <i>The MATLAB Language</i> .....	30
3.3.5 <i>MATLAB Graphics</i> .....	30

3.3.6	<i>MATLAB External Interfaces</i> .....	30
3.4	GEANT4.....	30
3.4.1	<i>GEANT4 Scope of Application</i> .....	30
3.4.2	<i>History of GEANT4</i> .....	33
3.4.3	<i>GEANT4 Functionality</i> .....	35
3.4.4	<i>GEANT4 detector simulation</i> .....	36
3.5	PRIMARY INTERACTION MONTE CARLO SIMULATION METHOD .....	40
3.5.1	<i>Gamma ray detector efficiency for point isotropic sources</i> .....	40
3.5.2	<i>Mathematical foundation for point isotropic source geometry</i> .....	40
3.5.3	<i>Gamma ray detector efficiency for thin circular disk sources</i> .....	45
3.5.4	<i>Mathematical foundation for disk source geometry</i> .....	45
3.6	REFERENCES.....	50
<b>CHAPTER 4.....</b>		<b>53</b>
<b>INTEGRAL PARAMETER MEASUREMENT.....</b>		<b>53</b>
4.1	PEAK-TO-TOTAL RATIO FOR DETECTOR EFFICIENCY MEASUREMENT .....	53
4.2	GEANT4 FOR CALCULATION OF PEAK-TO-TOTAL RATIO .....	59
4.2.1	<i>Small High Purity Germanium Detector used in Nuclear Power Plants</i> .....	59
4.2.2	<i>GEANT4 Model and Simulations</i> .....	60
4.3	ESTIMATION OF PEAK-TO-TOTAL RATIO USING GEANT4 .....	63
4.4	REFERENCES.....	64
<b>CHAPTER 5.....</b>		<b>67</b>
<b>RESULTS AND DISCUSSIONS .....</b>		<b>67</b>
5.1	RESULTS OF PRIMARY INTERACTION MONTE CARLO MODEL .....	67
5.1.1	<i>Results of point isotropic gamma ray source</i> .....	67
5.1.2	<i>Results of circular disk gamma ray source</i> .....	76
5.2	GEANT4 SIMULATION OF SMALL SIZE HPGe DETECTOR.....	88

5.3	MEASUREMENT OF PEAK-TO-TOTAL RATIO USING GEANT4 .....	99
5.4	REFERENCES.....	111
<b>CHAPTER 6.....</b>		<b>114</b>
<b>SUMMARY, CONCLUSIONS AND RECOMMENDATIONS FOR FUTURE WORK .....</b>		<b>114</b>
6.1	PRIMARY INTERACTION MONTE CARLO SIMULATION .....	114
6.2	GEANT4 SIMULATION OF HIGH PURITY GERMANIUM DETECTOR .....	115
6.3	GENERAL CONCLUSIONS .....	116
6.4	RECOMMENDATIONS FOR FUTURE WORK.....	116
<b>APPENDIX-I.....</b>		<b>118</b>
<b>APPENDIX-II .....</b>		<b>123</b>
DETECTORCONSTRUCTION .....		123
PHYSICSLIST.....		130
RUNACTION.....		136
STEPPINGACTION.....		139
<b>APPENDIX-III.....</b>		<b>141</b>