

MICROWAVE ABSORBER WITH SPLIT RING RESONATOR (SRR)

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Sesi Pengajian :

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Special dedicate to my lovely parents, my brother and sister who give me encouragement to success in my studies and not to forget special thanks to all my lecturers and friends that give me guideline and support that help me accomplish my report during my study in

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ABSTRACT

Proper understanding of microwave and split ring resonator is important to design a microwave absorber with split ring resonator (SRR). Therefore, in this project, a method for designing a better reflection loss performance for truncated microwave absorber with split ring resonator has been investigated. Split ring resonator or metamaterial is a type of artificial structure that is not found in the nature. This structure has become an interest among many due to its extraordinary response to electromagnetic waves. The split ring resonator is an example of a metamaterial structure which has the potential to improve the performances of components in microwave without changing the material or with additional radiators. In this thesis, it present the investigation of reflection loss or S_{11} for the 1x1 truncated microwave absorber with the integration of different number of split ring resonator structure at the truncated absorber for a frequency range between 6 GHz to 15 GHz through design and simulation process by using CST studio Suite 2014 software. Various S_{11} performances are compared and simulation result for the integration of one double split ring resonator (D-SRR) structure on truncated pyramidal microwave absorber show improvement performance of reflection loss at most of frequency from 6GHz to 15GHz and give the best reflection loss at frequency of 7.39 GHz which is -58.61 dB. Then, the design split ring resonator been simulate for 3 different frequency and modeled using Matlab software. The truncated microwave absorber used in this project is made of agricultural waste, which is rice husk mixed with Urea Formaldehyde as it bonding agent with dielectric constant of 2.9. Thus, this will able to reduce the fabrication cost and more environments friendly.

ABSTRAK

Pemahaman yang betul mengenai gelombang mikro dan resonator cincin terbelah adalah penting dalam mereka bentuk penyerap gelombang mikro dengan resonator cincin terbelah (SRR). Oleh itu, dalam projek ini, satu kaedah untuk mereka bentuk prestasi kehilangan pantulan yang lebih baik untuk penyerap gelombang mikro dengan resonator cincin terbelah telah diasas. Resonator cincin terbelah atau meta bahan adalah sejenis struktur buatan yang tidak dapat dijumpai secara semula jadi. Struktur ini telah menjadi subjek penting di kalangan ramai berikutan sambutan yang luar biasa terhadap gelombang elektromagnet. Resonator cincin terbelah adalah contoh struktur meta bahan yang mempunyai potensi untuk meningkatkan prestasi komponen gelombang mikro tanpa mengubah bahan atau dengan tambahan radiator. Dalam tesis ini, ia membentangkan siasatan kehilangan pantulan atau S_{11} untuk 1x1 penyerap gelombang mikro dengan jumlah integrasi berbeza bagi struktur resonator cincin terbelah bagi julat frekuensi antara 6 GHz hingga 15 GHz melalui reka bentuk dan simulasi proses menggunakan CST studio Suite perisian 2014. Pelbagai prestasi S_{11} dibandingkan dan keputusan simulasi bagi integrasi satu resonator cincin terbelah berkembar (D-SRR) pada struktur piramid gelombang mikro yang dipangkas menunjukkan peningkatan prestasikehilangan pantulan di kebanyakan frekuensi dari 6GHz kepada 15GHz dan memberikan kehilangan pantulan yang terbaik pada frekuensi 7.39 GHz dimana -58.61 dB. Kemudian, reka bentuk resonator cincin terbelahdisimulasi untuk 3 frekuensi yang berbeza dan dimodelkan menggunakan perisian Matlab. Penyerap gelombang mikro yang digunakan dalam projek ini diperbuat daripada bahan buangan pertanian, iaitu sekam padi dicampur dengan Urea Formaldehyde sebagai ejen penyambungan dimana mempunyai pemalar dielektrik 2.9. Oleh itu, ini dapat mengurangkan kos pembuatan dan memberi persekitaran yang lebih mesra alam.

TABLE OF CONTENTS

CHAPTER	CONTENT	PAGE
	Title of project	i
	Status Report Form	ii
	Student Declaration	iii
	Supervisor Declaration	iv
	Dedication	v
	Acknowledgement	vi
	Abstract	vii
	Abstrak	viii
	Table of Content	ix
	List of Tables	xv
	List of Figures	xvii
	List of Equation	xxii
	List of Abbreviation	Xxiii

I	Introduction	1
	1.1 Introduction	2
	1.2 Overview Project	4
	1.3 Objective of Study	7
	1.4 Scope of Work	7
	1.5 Problem Statement	8
	1.6 Methodology	9
	1.7 Thesis Outline	11
II	Literature Review	13
	2.1 Introduction	14
	2.2 Microwave Properties for Absorbing Materials	16
	2.3 Permittivity	16
	2.4 Loss Tangent, $\tan \delta_e$	16
	2.5 Anechoic Chamber	17
	2.5.1 Microwave Absorber	19
	2.6 Left Handed Material	20
	2.7 Refraction	21
	2.8 The Split Ring Resonator	22
	2.9 Summary	25

III	Project Methodology	26
	3.1 Overview Project Methodology	27
	3.2 Design Methodology	28
	3.3 Design Specification	30
	3.4 Pyramidal Microwave Absorber Design	31
	3.4.1 Truncated Pyramidal Microwave	31
	3.5 Single Square Split Ring Resonator (S-SRR) Design	32
	3.5.1 Double Square Split Ring Resonator (D-SRR) Design	33
	3.7 Truncated Pyramidal Microwave Absorber with One Double Square Split Ring Resonator (D-SRR) Design	34
	3.7 Simulation of Double Square Split Ring Resonator (D-SRR) Design	35
	3.8 Simulation of Pyramidal Microwave Absorber Design	36
IV	Result and Discussion	37
	4.1 Introduction	37
	4.2 Pyramidal Microwave Absorber Dimension Design	38

4.2.1 Truncated Pyramidal Microwave Absorber Dimension Design	39
4.3 Comparison Reflection Loss Performance for Basic Pyramidal Microwave Absorber with Truncated Pyramidal Microwave Absorber	41
4.4 Single Square Split Ring Resonator (S-SRR) Dimension Design	42
4.4.1 Double Square Split Ring Resonator (D-SRR) Dimension Design	44
4.5 Truncated Pyramidal Microwave Absorber with One Double Square Split Ring Resonator (D-SRR) Design	46
4.5.1 Truncated Pyramidal Microwave Absorber with Two Double Square Split Ring Resonator (D-SRR) Design	47
4.5.2 Truncated Pyramidal Microwave Absorber with Array of Four Double Square Split Ring Resonator (D-SRR) Design	48
4.6 Comparison Reflection Loss Performance for Truncated Pyramidal Microwave Absorber with different D- SRR Integration	49

4.7 Comparison Reflection Loss Performance for Truncated Pyramidal Microwave Absorber without D-SRR Integration and with One D-SRR Integration	50
4.8 Impedance Modeling of S-SRR Structure	51
4.8.1 Graph of Resistance and Reactance for one S-SRR Structure	54
4.8.2 Graph of Resistance and Reactance for two S-SRR Structures	55
4.8.3 Graph of Resistance and Reactance for four S-SRR Structures	56
4.9 Impedance Modeling of D-SRR Structure	58
4.9.1 Graph of Resistance and Reactance for one D-SRR Structure	61
4.9.2 Graph of Resistance and Reactance for two D-SRR Structure	62
4.9.3 Graph of Resistance and Reactance for four D-SRR	63

Structure

V	Conclusion & Future Work	65
	5.1 Conclusion	65
	5.2 Recommendation on Future Work	66
	REFERENCE	68

LIST OF TABLES

TABLE NUMBER	TITLE	PAGE
2.1	Microwave Frequency Bands	15
3.1	Design specification of FR4 substrate properties for the SRR	30
3.2	Design specification of truncated pyramidal microwave absorber	30
4.1	The dimension of the basic pyramidal microwave absorber	38
4.2	The dimension of the truncated pyramidal microwave absorber	40
4.3	The dimension of the Single Square Split Ring Resonator (S-SRR) Design	43
4.4	The dimension of the Double Square Split Ring Resonator (D-SRR) Design	45
4.5	Impedance modeling of resistance, R and reactance, X for one structure of single split ring resonator at three different frequencies.	52

4.6	Impedance modeling of resistance, R and reactance, X for two structures of single split ring resonators at three different frequencies.	52
4.7	Impedance modeling of resistance, R and reactance, X for four structures of single split ring resonators at three different frequencies.	53
4.8	Impedance modeling of resistance, R and reactance, X for one structure of double split ring resonator at three different frequencies.	59
4.9	Impedance modeling of resistance, R and reactance, X for two structure of double split ring resonator at three different frequencies.	59
4.10	Impedance modeling of resistance, R and reactance, X for four structure of double split ring resonator at three different frequencies.	60

LIST OF FIGURES

FIGURE NUMBER	TITLE	PAGE
1.1	Project Methodologies	10
2.1	Type of microwave absorber	20
2.2	Type of metamaterial	21
2.3	(a) A single unit cell of the SRR array and (b) its Equivalent LC Circuit	22
2.4	Schematic of single SRR and their corresponding reflectance spectra (Illustration Only) with (a) TE measurements of normal to surface incidence having the Electric field (dashed line) parallel to the SRR arms (parallel to the X-axis) and (b) TM measurements of normal to surface incidence having the Electric field perpendicular to the SRR arms (parallel to Y-axis).	23
2.5	Ways to increase absorber performance	25
3.1	Flow Chart Diagram	29
3.2	Pyramidal microwave absorber design; (a) side view; (b) front view.	31

3.3	Truncated pyramidal microwave absorber design; (a) side view; (b) front view.	32
3.4	Single split ring resonator design; (a) front view; (b) side view.	32
3.5	Double split ring resonator design; (a) front view; (b) side view.	33
3.6	Truncated microwave absorber with one D-SRR design; (a) side view; (b) front view.	34
3.7	Truncated absorber for (a) single (one) D-SRR, (b) double (two) D-SRR and (c) array (four) D-SRR structure	35
3.8	The simulation setup for the D-SRR structure.	35
3.9	The simulation setup of the truncated pyramidal absorber with one D-SRR structure.	36
4.1	Pyramidal microwave absorber dimension design; (a) side view; (b) front view.	38
4.2	Reflection loss for the 1x1 basic pyramidal microwave absorber	39
4.3	Truncated pyramidal microwave absorber design; (a) side view; (b) front view.	39
4.4	Reflection loss of the 1x1 truncated pyramidal microwave absorber.	40
4.5	Reflection loss performance for basic pyramidal microwave absorber compared with truncated microwave absorber.	41
4.6	Single square split ring resonator (S-SRR) design; (a) front	42

	view; (b) side view.	
4.7	Result of reflection loss or S_{11} for the S-SRR.	43
4.8	Double square split ring resonator (D-SRR) design; (a) front view; (b) side view.	44
4.9	Result of reflection loss or S_{11} for the D-SRR.	45
4.10	Truncated microwave absorber with integration of one D-SRR structure; (a) side view; (b) front view.	46
4.11	Reflection loss performance for truncated microwave absorber with integration of one D-SRR structure.	46
4.12	Truncated microwave absorber with integration of two D-SRR structure; (a) side view; (b) front view.	47
4.13	Reflection loss performance for truncated microwave absorber with integration of two D-SRR structure.	47
4.14	Truncated microwave absorber with integration of four D-SRR structure.	48
4.15	Reflection loss performance for truncated microwave absorber with integration of four D-SRR structure.	48
4.16	Reflection loss performance for truncated microwave absorber compared with integration of different D-SRR structure.	49
4.17	Reflection loss performance for truncated microwave absorber without D-SRR structure and with integration of one D-SRR structure.	50
4.18	The simulation setup for (a) one S-SRR, (b) two S-SRR and (c) four S-SRR structure.	51

4.19	Graph of resistance and reactance at frequency of 6.5 GHz; (a) Resistance Vs. length, (b) Reactance Vs. length.	54
4.20	Graph of resistance and reactance at frequency of 7.5 GHz; (a) Resistance Vs. length, (b) Reactance Vs. length.	54
4.21	Graph of resistance and reactance at frequency of 8.4 GHz; (a) Resistance Vs. length, (b) Reactance Vs. length.	54
4.22	Graph of resistance and reactance at frequency of 6.5 GHz; (a) Resistance Vs. length, (b) Reactance Vs. length.	55
4.23	Graph of resistance and reactance at frequency of 7.5 GHz; (a) Resistance Vs. length, (b) Reactance Vs. length	55
4.24	Graph of resistance and reactance at frequency of 8.4 GHz; (a) Resistance Vs. length, (b) Reactance Vs. length.	55
4.25	Graph of resistance and reactance at frequency of 6.5 GHz; (a) Resistance Vs. length, (b) Reactance Vs. length.	56
4.26	Graph of resistance and reactance at frequency of 7.5 GHz; (a) Resistance Vs. length, (b) Reactance Vs. length.	56
4.27	Graph of resistance and reactance at frequency of 8.4 GHz; (a) Resistance Vs. length, (b) Reactance Vs. length.	56
4.28	The simulation setup for (a) one D-SSR, (b) two D-SRR and (c) four D-SRR structure.	58
4.29	Graph of resistance and reactance at frequency of 6.5 GHz; (a) Resistance Vs. length, (b) Reactance Vs. length.	61
4.30	Graph of resistance and reactance at frequency of 7.5 GHz; (a) Resistance Vs. length, (b) Reactance Vs. length.	61
4.31	Graph of resistance and reactance at frequency of 8.4	61

	GHz; (a) Resistance Vs. length, (b) Reactance Vs. length.	
4.32	Graph of resistance and reactance at frequency of 6.5 GHz; (a) Resistance Vs. length, (b) Reactance Vs. length.	62
4.33	Graph of resistance and reactance at frequency of 7.5 GHz; (a) Resistance Vs. length, (b) Reactance Vs. length.	62
4.34	Graph of resistance and reactance at frequency of 8.4 GHz; (a) Resistance Vs. length, (b) Reactance Vs. length.	62
4.35	Graph of resistance and reactance at frequency of 6.5 GHz; (a) Resistance Vs. length, (b) Reactance Vs. length.	63
4.36	Graph of resistance and reactance at frequency of 7.5 GHz; (a) Resistance Vs. length, (b) Reactance Vs. length.	63
4.37	Graph of resistance and reactance at frequency of 8.4 GHz; (a) Resistance Vs. length, (b) Reactance Vs. length.	63

LIST OF EQUATION

EQUATION NUMBER	TITLE	PAGE
1.1	Formula of permittivity of free space	5
1.2	Formula of the wavelength	5
2.1	Dissipative factor or the loss tangent	17
2.2	Pure dielectric	17
2.3	Loss tangent for conductor	17

LIST OF ABBREVIATION

SRR	-	Split Ring Resonator
RCS	-	Radar Cross Section
RF	-	Radio Frequency
EMT	-	Effective Medium Theory
EM	-	Electromagnetic
EMC	-	Electromagnetic Compatibility
MMs	-	Metamaterials
MA	-	Metamaterial Absorber
AMC	-	Artificial Magnetic Conductor
EBG	-	Electromagnetic Band Gap
PBG	-	Photonic Band Gap
S-SRR	-	Single Split Ring Resonator
D-SRR	-	Double Split Ring Resonator
DUT	-	Device Under Test
LHMs	-	Left-Handed Materials

FSS	-	Frequency Selective Space
DMS	-	Defect Microstrip Structure
DGS	-	Defect Ground Structure
A-SRR	-	Array Split Ring Resonator
EC-SRR	-	Edge Couple Split Ring Resonator
BC-SRR	-	Broadside Couple Split Ring Resonator
NC-SRR	-	Nonbianisotropic Couple Split Ring Resonator