	Bachelor Thesis	Zum Verfasser

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Optimierung der Spulengeometrie für die kontaktlose Energieübertragung

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Abstract: Technology trends are moving toward a completely wireless and mobile world, and our device chargers have followed suit. Wireless charging, also known as inductive charging, is a convenient and fuss-free way to power up your smartphones and vehicles. Wireless power though is about to take a huge leap in scale, as kilowatts can now be transferred oven an air gap of hundreds of millimeters while still maintaining high-energy transfer efficiency.

Type	S_{21} (dB)	Frequency (MHz)	$(S_{21})^2$
Archimedean Spiral	-0.63	32.77	0.865
Logarithmic Spiral	-0.93	47.89	0.808
Inverse-log Spiral	-0.76	20.53	0.839

Simulation Results: S_{21} Parameter with distance between boards always 100 mm

For this thesis, two coils with number of turns are used in such a way, that each coil is attached to a PCB board and other side of this PCB board has a loop (which is one circle coil) with a gap of 0.5 mm, a discrete port is connected between this gap for input and output purpose. To get an accurate efficiency, role of parameters like coil's turns, width of coil, gap between successive turns and distance between boards is very important. Because efficiency ratio depends upon these parameters and shape of the coils. In whole project three geometrical shapes are formed named as Archimedean, Logarithmic and Inverse-log. All shapes are formed and simulated using CST Microwave Studio.

Following Formulas are used to form different spirals using various r factors. X and Y coordinates are described as:
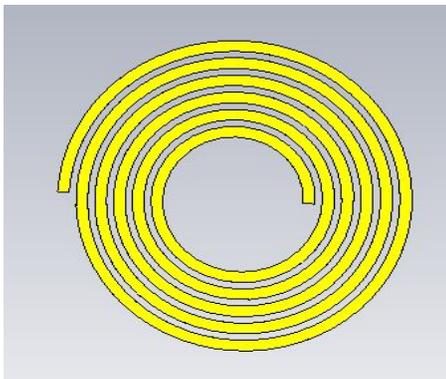
$$X = r * \cos(\varphi) \quad \text{and} \quad Y = r * \sin(\varphi)$$

Archimedean Spiral :

r is defined as: $r = a\varphi$
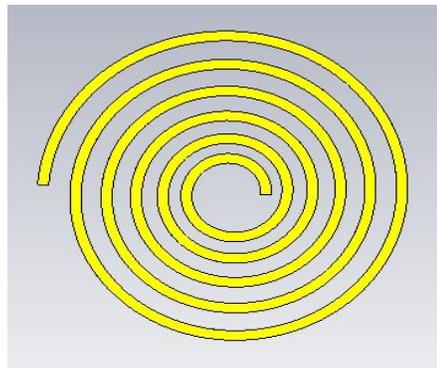where ,φ' turns the spiral, while ,a$'$ controls the distance between successive turns

Logarithmic Spiral:

r is defined as: $r = a\varphi^n$
where ,a' is taken as 1 for normal logarithmic spiral and ,n' is a progress factor with a value of 1.3.
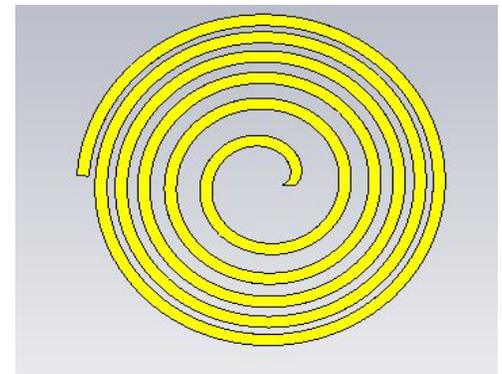
Inverse-log Spiral:

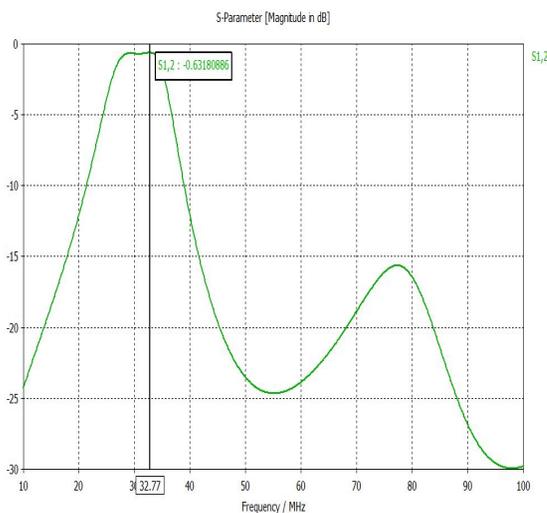r is defined as: $r = a\varphi^{1/n}$
where value of ,a' depends upon the gap and width of the coil and ,n' is 1.6.

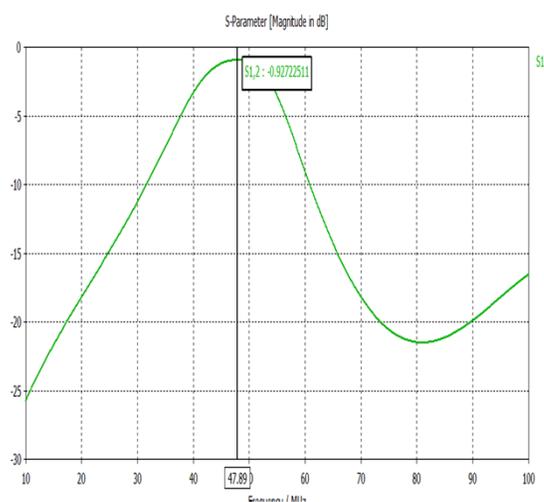Archimedean Spiral

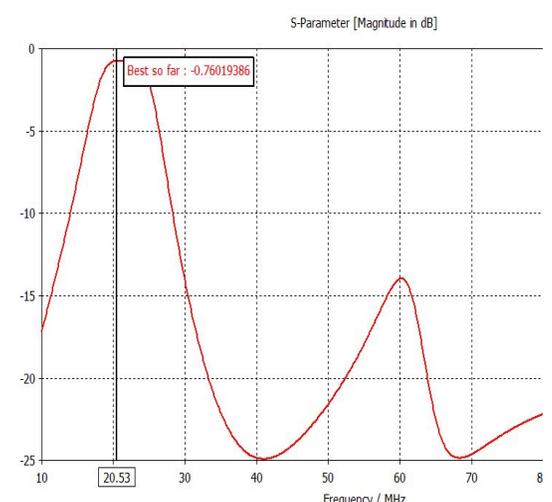Logarithmic Spiral

Inverse-log Spiral

* For all spirals,$'\varphi'$ depends upon the number of turns used for the coils.

Archimedean spiral (1D-results)

Log spiral (1D-results)

Inverse-log spiral (1D-results)