Using ANSYS MAXWELL Eddy Solver Calculation Of Field Component

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Abstract:-- **ANSYS Maxwell is high performance interactive electromagnetic field simulation software for engineers used for analysis and designing 2D and 3D electromagnetic electromechanical devices,including motor, actuator,sensor,transformer,coils etc.MAXWELL uses Finite element analysis and mesh analysis to solve static, frequency domain and time varying electromagnetic field.This software used to calculate magnetic flux density,magnetic intensity,force,torque,power loss,S-parameter,impedance,quality factor,Eigen frequency in power generator,resonant cavity,antenna radiation,waveguide devices. ANSYS electromagnetic solution aloe to user to gain an understanding of performance characteristic under applied load/excitation and boundary condition, visualization of electromagnetic field in and around field ,joule heating effect and resultant temperature, force distribution and resultant distribution.**

I. INTRODUCTION

Normally eddy current has more application mostly used in detection of cracks, coating thickness, eddy brake etc.

This eddy current in an object can be evaluated using ANSYS MAXWELL software also resulting ohmic losses, skin depth,calculation and its plot possible.

II. PROBLEM DEFINITION

AC 300 Hz current will be passed through a spiral coil which will induce eddy currents in an iron disk causing it to heat up
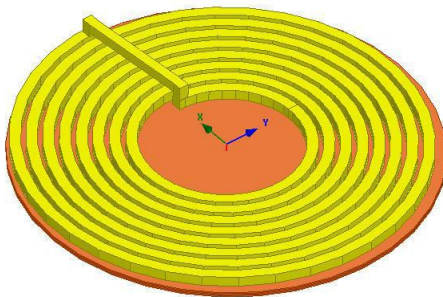

Figure No1. Spiral coil model

Design steps
♦ Set Solution Type- Eddy current
♦ Set Model Units

Figure No2. Set units

• *Draw Spiral*
In User Defined Primitive Operation window,
1. PolygonRadius: 1.5 cm
2. StartHelixRadius: 15 cm
3. RadiusChange: 3.1 cm
4. Pitch: 0 cm
5. Turns: 8
♦ Change the name of object to
♦ Coil
♦ Change the color to Yellow
♦ Change the material to Copper

	Name	Value	Unit	Evaluated Value	Description
	Command	CreateUserDefinedPart			
	Coordinate System	Global			
	DLL Name	SegmentedHelix/Polyg...			
	DLL Location	syslib			
	DLL Version	1.0			
	PolygonSegments	4		4	Number of cross-sectio...
	PolygonRadius	1.5	cm	1.5cm	Outer radius of cross-se...
	StartHelixRadius	15	cm	15cm	Start radius from polygo...
	RadiusChange	3.1	cm	3.1cm	Radius change per turn
	Pitch	0	cm	0cm	Helix pitch
	Turns	8		8	Number of turns
	SegmentsPerTurn	36		36	Number of segments p...
	RightHanded	1		1	Helix direction, non-zer...

Figure No3 Properties Window

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Draw Box- Here Cartesian co-ordinate system used which dimension and position of box.

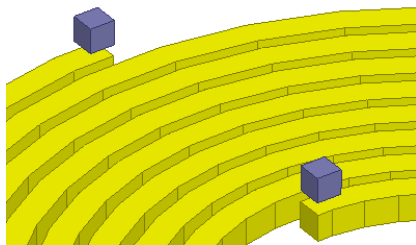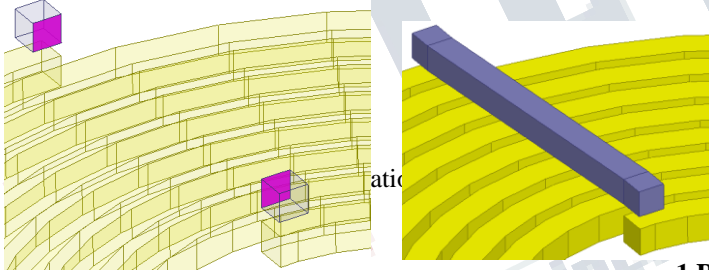### Draw another Box

Figure No4 .Dimension and position setting

Figure No5 .created box structure on spiral

Connect Surfaces and coil:The boxes created in last step and object created in this step will represent end connection of the coil

- **To create disk**:Change the name of the Object to Disk and color to Orange,also set the disk dimension.

- Change the material of the object to cast_iron

Figure No7. Spiral coil with disk model

Assign Excitations
- Create Coil Terminal

Select the object Coil from the history tree
– In Section window,
1. Section Plane: YZ
– Change the name of the resulting object to Coil_Terminal
– Select the sheet Coil Terminal from the history tree
– *Modeler –Boolean- Separate Bodies*
– Delete all the resulting sheets apart fromCoil_Terminal

...ion Plan...
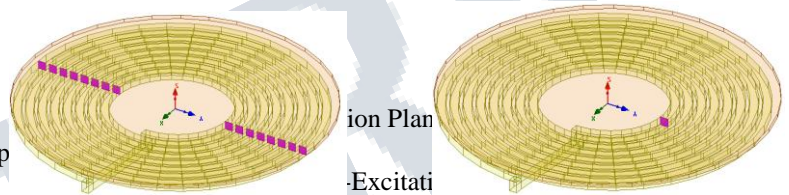
...Excitati...
boundary condition that define the sources of the magnetic and/or electric fields.

Figure No10 Window for setting excitation type
toutput parameter calculations:
1.Resolve Skin Depth-Select the face on the disk that is closest to the coil by setting coordinates value, also set skin depth related parameters.

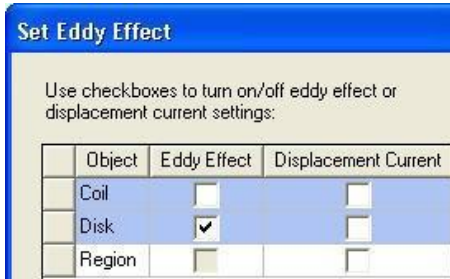Figure No11 Window for setting skin depth parameter

2.**To set Eddy Effect**

Figure No-12 Set Eddy calculation for disc

3.**Calculate Total Ohmic Loss:** Calculate Ohmic Losses in Disk ,select the menu item Maxwell 3D -Fields - Calculator

− In Fields Calculator window,

Select Scl : Ohmic-Loss

Input Ohmic Loss Vol : Volume(Disk)
    Geometry

    Volume Scl : Integrate(Volume(Disk), Ohmic-Loss) he evaluated value of losses in the Disk should be around 270.48 W .
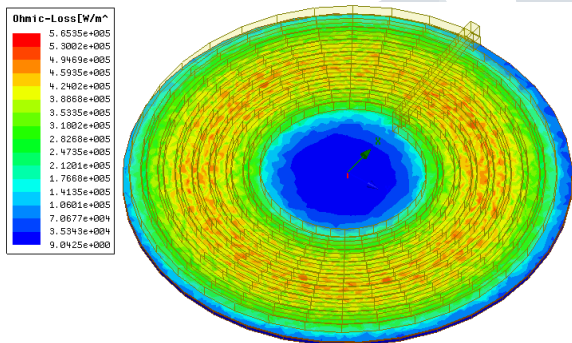
Counter plot:
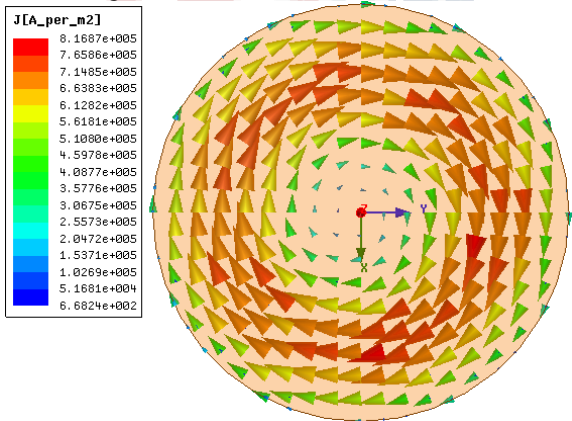

Figure No12 PlotOhmic Loss Distribution

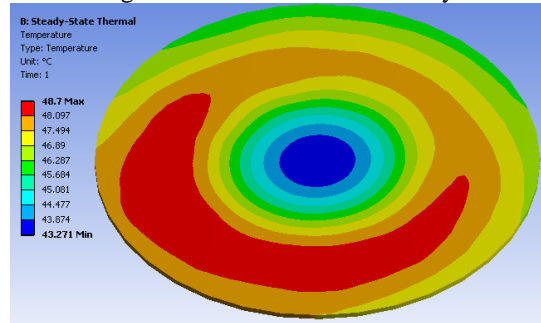Figure No13Plot Current Density Vectors

Figure No-14Temperature distribution on Disk will be displayed in graphic window

Conclusion:

Using ANSYS MAXWELL software easy to analyze result by mapping calculating as well graphical solution.One of the advantage of this software is it provides visualization of distribution of field.

References:

1. Maxwell 3D User's Guide
2. Ansys Maxwell software
3. Ansys Maxwell Tutorial
4. Ansys Maxwell Torrent