

.FEM File Format¹

1 Problem Parameters

The problem definition is given by several parameters in the beginning,

[Format]	float	-	format version of the file
[Frequency]	float	Hz	frequency for harmonic problems
[Precision]	float	-	computing precision within FEMM
[MinAngle]	float	deg	angle restriction for the triangulation
[Depth]	float	lfac	typical length in z -direction
[LengthUnits]	string	-	unit used for lengths, e.g. • meters • centimeters • millimeters • inches We will denote the unit by lfac in the following.
[Coordinates]	string	-	definition of the coordinate system
[ProblemType]	string	-	the 2D problem is either planar or axisymmetric
[extZo]	float	lfac	center of exterior (only if [ProblemType] is axisymmetric)
[extRo]	float	lfac	radius of exterior (only if [ProblemType] is axisymmetric)
[extRi]	float	lfac	radius radius of interior (only if [ProblemType] is axisymmetric)
[Comment]	string	-	problem description

2 Property Sections

2.1 Point Properties

This section defines boundary conditions on nodes,

[PointProps]	float	number of point subsections
<BeginPoint>		the beginning of a new point subsection
...		data of the subsection
<EndPoint>		marks the end of a point subsection

Each subsection contains between <BeginPoint> and <EndPoint>

<PointName>	string	-	property description
<A_re>	float	Wb/m	real component of the magnetic vector potential
<A_im>	float	Wb/m	imaginary component of the magnetic vector potential
<I_re>	float	A	real component of the current

¹ Adapted from Sebastian Schoeps, "FEMMview File Format", 2009-06-09
<https://bitbucket.org/schoeps/fides/downloads/FEMMview.pdf>

<I_im>	float	A	imaginary component of the current
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2.2 Boundary Properties

This section defines the boundary conditions on segments and arcsegments,

[BdryProps] <BeginBdry>	float	number of boundary subsections the beginning of a new boundary subsection
...		data of the subsection
<EndBdry>		marks the end of a boundary subsection

Each subsection contains between <BeginBdry> and <EndBdry>

<BdryName>	string	-	description of the property
<type>	int	-	the following values are possible 1. prescribed A 2. small skin depth 3. mixed 4. strategic dual image 5. periodic 6. anti-periodic
<Musssd>	float	-	relative permeability (for <type>= 2)
<Sigmassd>	float	MS/m	conductivity (for <type>= 2)
<c0>	float	-	real part of first coefficient (for <type>= 3)
<c0i>	float	-	imag. part of first coef. (for <type>= 3)
<c1>	float	-	real part of second coef. (for <type>= 3)
<c1i>	float	-	imag. part of second coef. (for <type>= 3)
<A_0>	float	Wb/m	magnetic vector potential on the segment (for <type>= 1)
<A_1>	float	Wb/m	magnetic vector potential on the segment in xdirection (for <type>= 1)
<A_2>	float	Wb/m	magnetic vector potential on the segment in ydirection (for <type>= 1)
<Phi>	float	deg	angle (for <type>= 1)

2.3 Block Properties

This section defines the material properties,

[BlockProps] <BeginBlock>	float	number of block subsections the beginning of a new block subsection
...		data of the subsection
<EndBlock>		marks the end of a block subsection

Each subsection contains between <BeginBlock> and <EndBlock>

<BlockName>	string	-	description of the block
<Mu_x>	float	-	relative permeability in x-direction
<Mu_y>	float	-	relative permeability in y-direction
<H_c>	float	A/m	coercivity
<J_re>	float	MA/m ²	real part of the source current density

<J _{im} >	float	MA/m ²	imaginary part of the source current density
<Sigma>	float	MS/m	conductivity
<Phi _h >	float	deg	hysteresis lag angle for nonlinear problems
<Phi _{hx} >	float	deg	hysteresis lag angle in x-direction for linear problems
<Phi _{hy} >	float	deg	hysteresis lag angle in y-direction for linear problems
<BHPoints> ...	int float array	- -	number of data points for interpolation <BHPoints>*2-array of data points (only if <BHPoints> is greater than 0)
	float	Tesla	Flux density of B-H curve data point
	float	A/m	Field intensity of B-H curve data point
<d _{lam} > <LamFill> <NStrands> <WireD> <LamType>	int float int float int	mm - - mm -	lamination thickness fraction of the volume occupied per lamination. Should specify 1 as the default rather than 0 if the region is not laminated. number of strands diameter of each wire possible values are 0. non-laminated or stranded (if <NStrands> is set) or laminated in plane (if <d _{lam} > and <LamFill> are set) 1. lamination parallel to x (planar) or r (axisymmetric) 2. lamination parallel to y (planar) or z (axisymmetric) 3. magnet wire 4. plain stranded wire 5. litz wire 6. square wire

2.4 Circuit Properties

This section defines the block material properties of circuits,

[CircuitProps] <BeginCircuit> ... <EndCircuit>	float	number of circuits subsections the beginning of a new circuits subsection data of the subsection marks the end of a circuits subsection
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Each subsection contains between <BeginCircuit> and <EndCircuit>

<CircuitName>	string	-	description of the block
<type>	int	-	possible values are 0. parallel 1. series

<TotalAmpsre>	float	A	real part of the circuit current
<TotalAmpsIm>	float	A	imaginary part of the circuit current

3 Points

This section defines the points,

[NumPoints]	int	Number of points	
	array	<NumPoints> x 4 array of points. Each row corresponds to a point and it contains the following columns	
	float	lfac	x-position of the point or r (axisymmetric)
	float	lfac	y-position of the point or z (axisymmetric)
	int	-	number of associated node property. 0 indicates no associated property; 1 or above indexes the associated nodal property
	int	-	number of group

4 Segments

This section defines segments.

[NumSegments]	int	number of segments	
...	array	<NumSegments>x6-array of segments. Each row corresponds to a segment and it contains the following columns	
	int	-	the number of the start point
	int	-	the number of the end point
	float	-	the mesh size factor (-1 means auto)
	int	-	the number of boundary property
	int	-	hide in postprocessor (0 for no, 1 for yes)
	int	-	number of group

5 ArcSegments

This section defines arcsegments,

[NumArcSegments]	int	number of arcsegments	
...	array	<NumSegments>x7-array of arcsegments. Each row corresponds to a arcsegments and it contains the following columns	
	int	-	the number of the start point
	int	-	the number of the end point
	float	deg	arc angle (1 to 180 deg)
	float	deg	max segment (0.01 to 10)
	int	-	the number of boundary property

	int	-	hide in postprocessor (0 for no, 1 for yes)
	int	-	number of group

6 Holes

This section defines non-meshed holes in the solution domain

[NumHoles]	int	number of holes	
...	array	<NumHoles>*3-array of info on each hole. Each row corresponds to hole and it contains the following columns	
	float	lfac	x-position of the BlockLabel or r (axisymmetric)
	float	lfac	y-position of the BlockLabel or z (axisymmetric)
	int	--	Number of group associated with the hole

7 Block Labels

This section defines block labels,

[NumBlockLabels]	int	number of block labels	
...	array	<NumBlockLabels>*9-array of block labels. Each row corresponds to a block label and it contains the following columns	
	float	lfac	x-position of the BlockLabel or r (axisymmetric)
	float	lfac	y-position of the BlockLabel or z (axisymmetric)
	int	-	number of block type (region)
	float	-	desired mesh size
	int	-	number of the associated circuit (first circuit number is 1; 0 indicates no associated circuit)
	float	deg	Magnetization direction
	int	-	number of group
	int	-	number turns (for stranded conductor coupling); 1 if not a stranded conductor
	int	-	Flag where a value of 1 denotes that block label located in external region (for axisymmetric Kelvin Transformation boundary conditions); otherwise zero.