.FEM File Format[[1]](#footnote-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 |

# Property Sections

## 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 |
| <I\_im> | float | A | imaginary component of the current |

## Boundary Properties

This section defines the boundary conditions on segments and arcsegments,

|  |  |  |
| --- | --- | --- |
| [BdryProps] | float | number of boundary subsections |
| <BeginBdry> |  | 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 |
| <Mussd> | 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) |

## Block Properties

This section defines the material properties,

|  |  |  |
| --- | --- | --- |
| [BlockProps] | float | number of block subsections |
| <BeginBlock> |  | 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/m2 | real part of the source current density |
| <J\_im> | float | MA/m2 | 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 | - | number of data points for interpolation |
| ··· | float array | - | <BHPoints>×2-array of data points (only if  <BHPoints> is greater than 0) |
|  | float | Tesla | Flux density of B-H curve data poind |
|  | float | A/m | Field intensity of B-H curve data point |
| <d\_lam> | int | mm | lamination thickness |
| <LamFill> | float | - | fraction of the volume occupied per lamination. Should specify 1 as the default rather than 0 if the region is not laminated. |
| <NStrands> | int | - | number of strands |
| <WireD> | float | mm | diameter of each wire |
| <LamType> | int | - | possible values are   1. non-laminated or stranded (if <NStrands> is set) or laminated in plane (if <d lam> and <LamFill> are set) 2. lamination parallel to x (planar) or r (axisymmetric) 3. lamination parallel to y (planar) or z (axisymmetric) 4. magnet wire 5. plain stranded wire 6. litz wire 7. square wire |

## Circuit Properties

This section defines the block material properties of circuits,

|  |  |  |
| --- | --- | --- |
| [CircuitProps] | float | number of circuits subsections |
| <BeginCircuit> |  | the beginning of a new circuits subsection |
| ··· |  | data of the subsection |
| <EndCircuit> |  | marks the end of a circuits subsection |

Each subsection contains between <BeginCircuit> and <EndCircuit>

|  |  |  |  |
| --- | --- | --- | --- |
| <CircuitName> | string | - | description of the block |
| <type> | int | - | possible values are   1. parallel 2. series |
| <TotalAmpsre> | float | A | real part of the circuit current |
| <TotalAmpsim> | float | A | imaginary part of the circuit current |

# 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 |

# Segments

This section defines segments.

|  |  |  |  |
| --- | --- | --- | --- |
| [NumSegments] | int | number of segments | |
| ··· | array | <NumSegments>×6-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 |

# ArcSegments

This section defines arcsegments,

|  |  |  |  |
| --- | --- | --- | --- |
| [NumArcSegments] | int | number of arcsegments | |
| ··· | array | <NumSegments>×7-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 |

# 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 |

# 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. |

1. Adapted from Sebastian Schoeps, “FEMMview File Format”, 2009-06-09

   <https://bitbucket.org/schoeps/fides/downloads/FEMMview.pdf> [↑](#footnote-ref-1)