QuickField simulations for electron/ion optics

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QuickField Analysis Options

Magnetic Suite
- AC Magnetics
- Transient + DC Magnetics
- DC Magnetics

Electric Suite
- AC conduction + Electrostatics & DC conduction
- Transient Electric + Electrostatics & DC conduction
- Electrostatics & DC conduction

Thermostructural
- Stress Analysis
- Transient Heat transfer
- Steady State Heat transfer
Non-relativistic particle mechanics

\[ F = q \left( E + V \times B \right) \]
\[ \frac{dV}{dt} = \frac{F}{m} \]

**F** – Lorentz force [N]
**E** – electric field strength vector [V/m]
**B** – magnetic field flux density vector [T]
**V** – particle speed vector [m/s]
**q** – particle charge [C]
**m** – particle mass [Kg]
Field export and local values

Welcome to the field export wizard. Here you can produce a file suitable for further exploration with other calculation or visualisation software tools. Depending upon the capabilities of your field analyzing software you may wish to export field values in each finite element node, or using a rectangular grid.

Local Values

- Potential A = -0.00316 Wb/m
- Flux Density B = 0.02 T
- Flux Density B_x = -1.43e-11 T
- Flux Density B_y = -0.02 T
- Strength H_x = -1.137e-5 A/m
- Strength H_y = -1.5915 A/m
- Permeability μ = 1
- Energy Density w = 159.15 J/m³
Open object interface
ActiveField API object model

QuickField Object Model

Top Level Objects
- Application
- Problems
- SolvingState
- Windows
- MainWindow

Objects for manipulating with labels and physical data
- DataDocs
- Labels
- DataDoc
- Edge
- Vertex
- LabelBlockES
- LabelBlockCF
- LabelBlockEC
- LabelBlockMS
- LabelBlockHE
- LabelBlockHT
- LabelEdgeES
- LabelEdgeCF
- LabelEdgeEC
- LabelEdgeMS
- LabelEdgeHE
- LabelEdgeHT
- LabelVertexES
- LabelVertexCF
- LabelVertexEC
- LabelVertexMS
- LabelVertexHE
- LabelVertexHT
QuickField simulations for electron/ion optics

1. Charged particle in uniform electrostatic field (capacitor).
2. Electrostatic particle accelerator.
3. Charged particle in uniform magnetic field (coil).
Charged particle in uniform electrostatic field

Problem specification:

\[ U_- = 0 \text{ V} \]
\[ U_+ = 1 \text{ V} \]
\[ q = -1.602 \times 10^{-19} \text{ C} \]
\[ m = 3.602 \times 10^{-19} \text{ kg} \]

Lorentz force:

\[ \mathbf{F} = q \mathbf{E} \]
Electrostatic particle accelerator

Problem specification:

- U- = -15 kV
- U+ = +15 kV
- q = -1.602E-19 C
- m = 9.109E-31 kg

Lorentz force:

\[ F = qE \]
Charged particle in uniform DC magnetic field

Lorentz force:
\[ F = q [V \times B] \]

Problem specification:

- \( B_x = -4 \) mT
- \( q = -1.602 \times 10^{-19} \text{ C} \)
- \( m = 9.109 \times 10^{-31} \text{ kg} \)
- \( V_x = V_y = 500 \text{ km/s} \)
Electron lens

Problem specification:

Coil current $I = 10 \text{ A}$
$q = -1.602E-19 \text{ C}$
$m = 9.109E-31 \text{ kg}$
$V_y = 300 \text{ km/s}$
$V_z = 1000 \text{ km/s}$

Lorentz force:

$F = q [V \times B]$
Garfield is an open-source code developed by Dr. Rob Veenhov from CERN for the detailed simulation of the gaseous detectors.
http://garfield.web.cern.ch/garfield/

SIMION is a software package by Scientific Instrument Services Inc. for charged particle optics simulation.
http://simion.com/info/quickfield.html
SIMION and QuickField Integration Tutorial

Including Magnetic Field Import

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