Phenomenological calculations

Flux density

Flux densities are calculated using `fluxdensitySquare(lpd, b, a, x, y)` and `fluxdensitySquare(lpd, b, a, x, y)`.

`lpd - London's penetration depth`

`b - Magnetic field strength`

`a - Lattice constant`

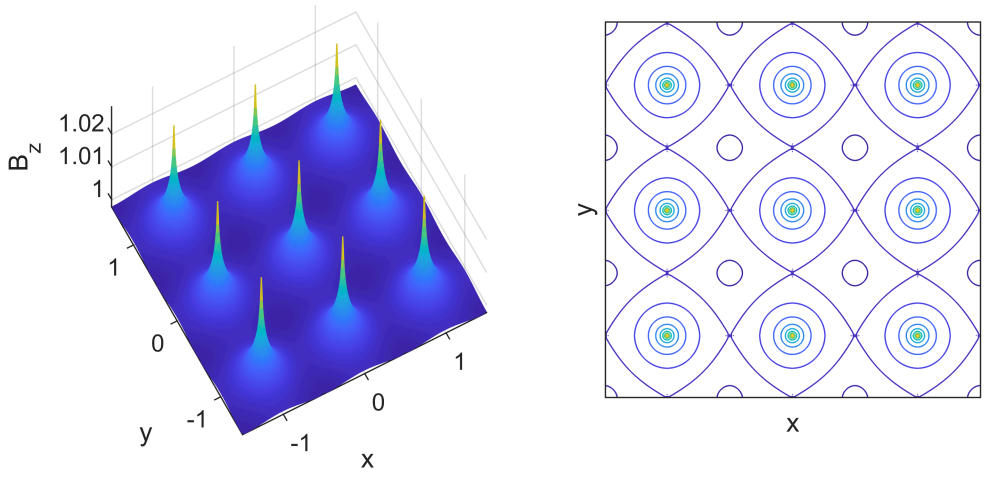
`x,y - Coordinates, can be scalar or mesh of coordinates`

`dataHexCode.m` and `dataSquareCode.m` is used to generate flux density data `datahex.mat` and `datasquare.mat` in hexagonal and square lattice respectively.

In the following codes, generated data were imported and plotted.

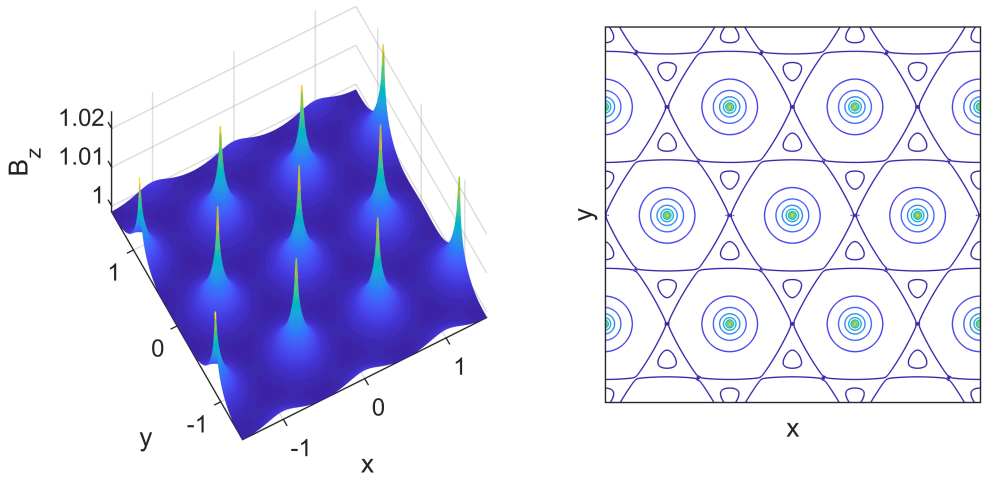
Flux density of the square lattice:

```
run("fluxPlotSquare.m")
```



Flux density of the hexagonal lattice:

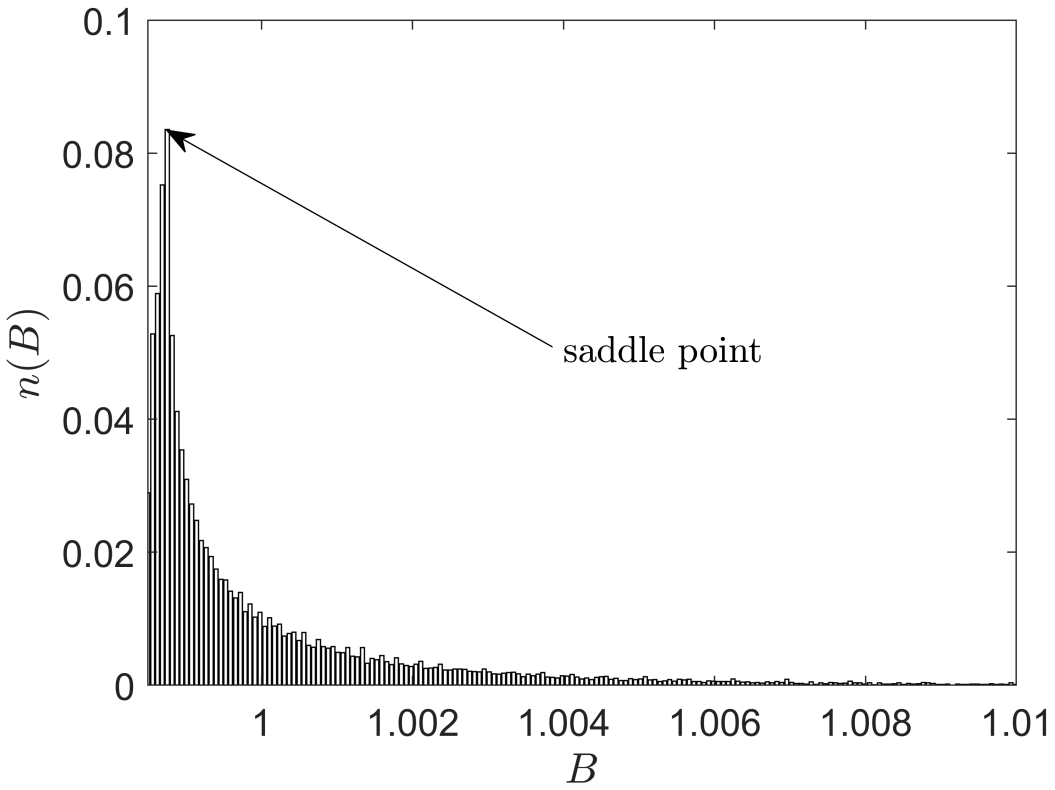
```
run('fluxPlotHex.m')
```



Flux histogram of hexagonal lattice:

```
run('fluxPlotHistogram.m')
```

```
Warning: Class 'Annotate' uses an undocumented syntax to restrict property values. Use property validation
 syntax instead. This warning will become an error in a future release.
```



Free energy

Free energy are calculated using `freeEnergyHex(a, b, lpd, N)` and `freeEnergySquare(a, b, lpd, N)`.

`lpd - London's penetration depth`

`b - Magnetic field strength`

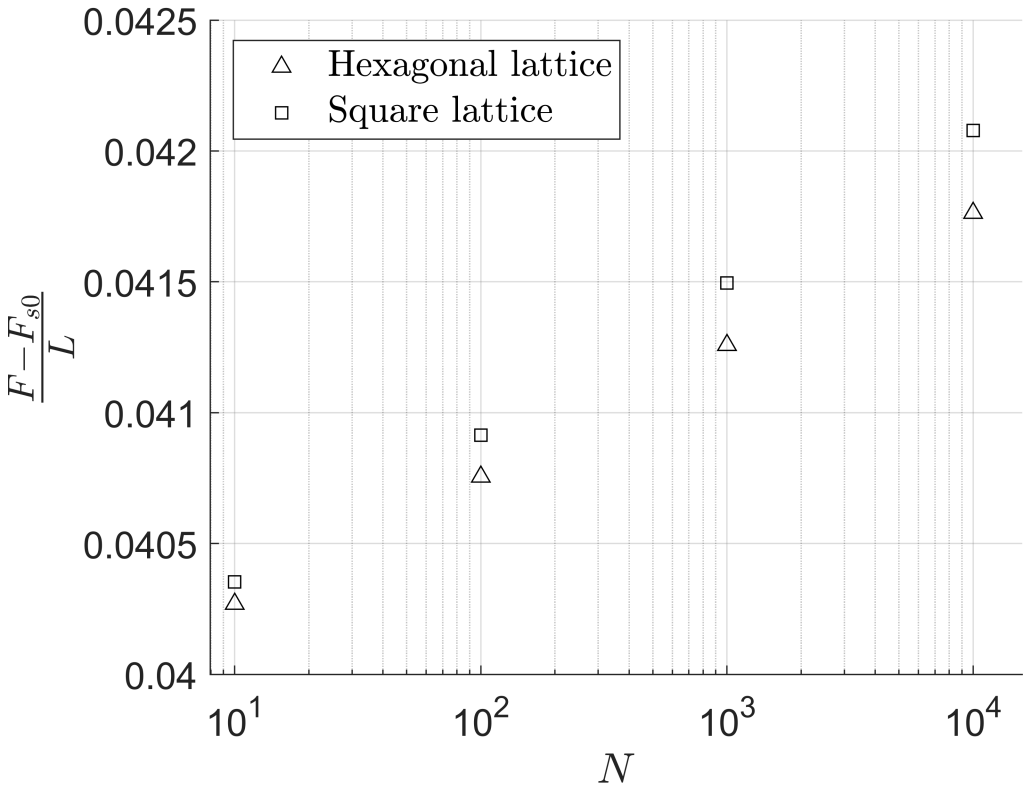
`a - Lattice constant`

`N - Lattice length (for one side, i.e. size is N*N)`

`freeenergy.m` is used to generate struct for energy of both hexagonal and square lattice in different lattice length `N`.

Plot source code:

```
run("freeEnergyPlot.m")
```



Supercurrent

Supercurrent are calculated using `currentSquare(lpd, b, a, x, y)`.

`lpd - London's penetration depth`

`b - Magnetic field strength`

`a - Lattice constant`

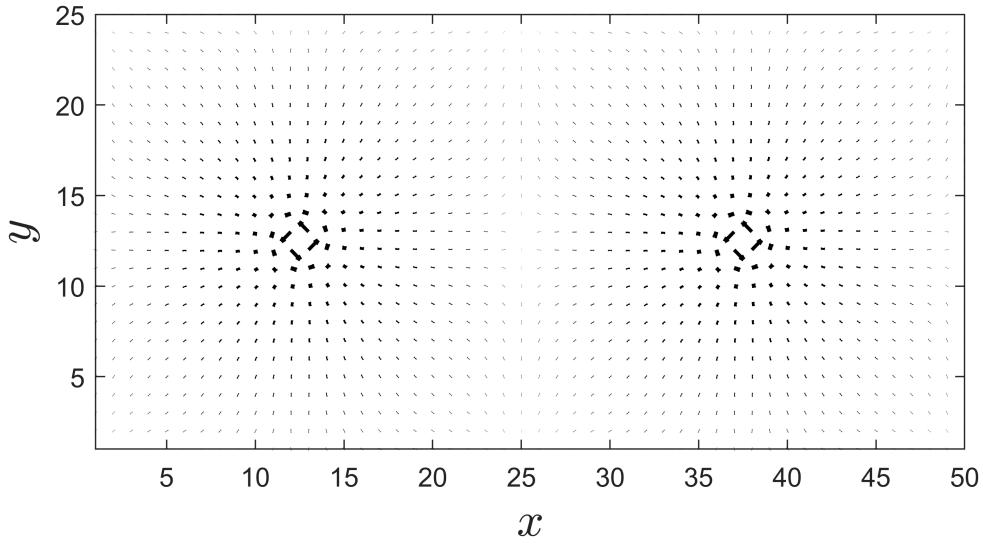
`x,y - Coordinates, can be scalar or mesh of coordinates`

`dataCurrentSquareCode.m` is used to generate flux density data `datacurrentsquare.mat` in square lattice.

Plot source code:

```
run('currentSquarePlot.m')
```

```
Warning: Using only the real component of complex data.
```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20
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y
5
10
15
20
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35
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45
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x