

# Question 10

**Q:** How does Femtet calculate inductance?

(Magnetic analysis/Measurement/Coil)

**A:** Femtet calculates inductance from energy.

Self-inductance,  $L$ , and magnetic energy,  $W_m$ , have a relationship given by the equation:

$$L = 2 * W_m / (I^2), \text{ where } I \text{ is electric current.}$$

To calculate self-inductance, magnetic energy needs to be determined.

Magnetic energy can be calculated using the equation:

$$W_m = 1/2 * \int B * H \, dV,$$

where

$B$ : magnetic flux density,

$H$ : Magnetic field,

$V$ : Analysis domain.

The equation above can also be transformed to the equation:

$$W_m = 1/2 * \int A * J \, dT,$$

where

$A$ : Vector potential,

$J$ : Current density,

$T$ : the domain where current flows, or the inside of the conductor.

In the magnetic analysis, both the distributions of vector potential and current density have been obtained.

By multiplying those distributions and integrating the result within the conductor, the magnetic energy can be calculated.