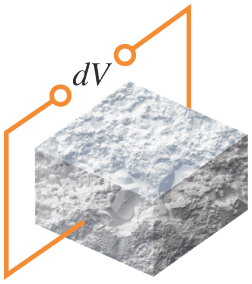
Electrical Conductivity

Electrical conductivity (formation factor) is the rock's capacity to transmit electrical current.

Ingrain uses the finite element method (FEM) to solve the Laplace equation for the electric potential field inside a digital sample for a specified potential difference at the boundaries.

Electrical potential applied to a tight sandstone digital sample



FEM solves the Laplace equation in complex pore space

Electrical potential

$$\nabla(\sigma\nabla V) = 0$$

Local conductivity

Computer simulation

The electrical current field in the pores is computed and then summed-up to obtain the total current through the sample. The effective conductivity of the sample is simply the ratio of this current to the potential drop per unit length.

Ohm's law for electrical conductivity

Effective conductivity

Total current

$$\vec{\sigma}_{Eff} = -\frac{\vec{J}}{dV}$$

Applied potential difference