



Electromagnetics:
Electromagnetic Field Theory

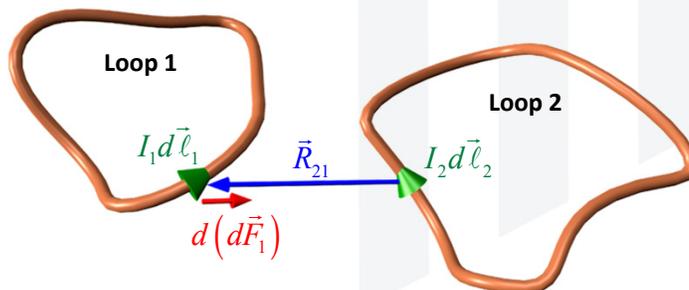
Force Between Two Current Loops

1

Setup

To calculate the net force between two loops, use the same integral derived for two line currents, but the line integrals are now closed-contour integrals. The force on loop 1 is

$$\vec{F}_1 = \frac{\mu I_1 I_2}{4\pi} \oint_{L_1} \oint_{L_2} \frac{d\vec{\ell}_1 \times (d\vec{\ell}_2 \times \hat{a}_{21})}{R_{21}^2}$$



2

Setup

Write the same integral to calculate the force on loop 2.

$$\vec{F}_2 = \frac{\mu I_2 I_1}{4\pi} \oint_{L_1} \oint_{L_2} \frac{d\vec{\ell}_2 \times (d\vec{\ell}_1 \times \hat{a}_{12})}{R_{12}^2}$$

Comparing this to the equation for \vec{F}_1 , we see that

$$\vec{F}_2 = -\vec{F}_1 \quad \text{Forces are equal, but opposite directions.}$$

