Magnetostatics

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magnetic moment

The magnitude of the flux density can be defined by the mechanical torque $\boldsymbol{N}$ exerted on the magnetic dipole:

$$\boldsymbol{N} = \boldsymbol{\mu} \times \boldsymbol{B} \tag{1}$$

where $\boldsymbol{\mu}$ is the magnetic moment of the dipole.

0.1 Biot and Savart Law

If $\mathrm{d}\boldsymbol{l}$ is an element of length (pointing in the direction of current flow) of a filamentary wire that carries a current $\boldsymbol{I}$ and $\boldsymbol{x}$ is the coordinate vector from the element of length to an observation point P, then the elemental flux density $\mathrm{d}\boldsymbol{B}$ at the point P is given in magnitude and direction by

$$\mathrm{d}\boldsymbol{B} = kI\frac{(\mathrm{d}\boldsymbol{l} \times \boldsymbol{x})}{|\boldsymbol{x}|^3} \tag{2}$$