

## SURFACE AND VOLUME CURRENT DENSITY 2

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Reference: Griffiths, David J. (2007) Introduction to Electrodynamics, 3rd Edition; Prentice Hall - Problem 5.6.

A couple more examples of surface and volume current.

Given a disk with a uniform surface charge density  $\sigma$  rotating at angular speed  $\omega$ , its linear speed at a point  $r$  from the centre is  $v = \omega r$ , so its surface current is

$$(0.1) \quad K = \sigma \omega r$$

Now consider a uniformly charged sphere with density  $\rho$  spinning about its axis with angular speed  $\omega$ . If we centre a spherical coordinate system at the centre of the sphere and align the axis of rotation with the  $z$  axis, then a point at location  $(r, \theta, \phi)$  has linear speed  $r\omega \sin \theta$ , so the volume current density is

$$(0.2) \quad J = \rho r \omega \sin \theta$$