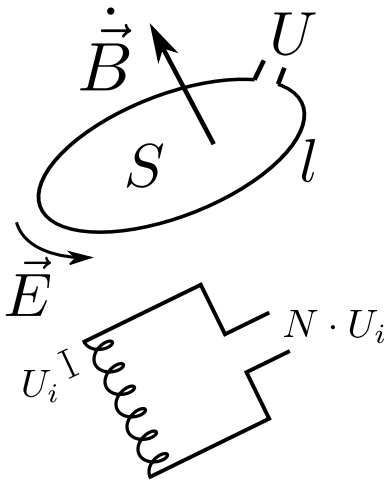
Magnetic coils



- A small coil of area A with N windings measure time varying magnetic field B.
- Voltage induce in one coil winding: $U_i = \oint_l \mathbf{E} \cdot d\mathbf{l}$
- Kelvin-Stokes theorem transforms closed boundary curve integral $\oint_l \mathbf{E} \cdot d\mathbf{l}$ into "circulations of the fields": $\iint_S \nabla \times \mathbf{E} \cdot d\mathbf{S}$
- From Faraday law $\nabla \times \mathbf{E} = -\partial \mathbf{B}/\partial t$ the induced voltage $U_i = -\iint_S \partial \mathbf{B}/\partial t \cdot \mathbf{S}$
- Considering constant surface $\mathbf{S} \perp \mathbf{B}$: $U_i = S\dot{B}$
- N windings of the coil generate $U = NS\dot{B}$
- Leads should be twisted to minimize external S.
- Raw signal should be integrated numerically or electrically to get real signal B.


H.-W.Bartels at al. (1993).
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lecture notes.


Wikipedia contributors (2018).
Maxwell's equations — Wikipedia, the free encyclopedia.
[Online; accessed 17-December-2018].