## Surface Integral

For a scalar function f over a surface parameterized by u and v, the surface integral is given by

$$\Phi = \int_{S} f \, \mathrm{d}a \tag{1.1}$$

$$= \int_{S} f(u, v) |\mathbf{T}_{u} \times \mathbf{T}_{v}| \, \mathrm{d}u \, \mathrm{d}v$$
 (1.2)

where  $\mathbf{T}_u$  and  $\mathbf{T}_v$  are tangent vectors and  $a \times b$  is the corss product.

For a vector function over a surface, the surface integral is given by

$$\Phi = \int_{S} \mathbf{F} \cdot d\mathbf{a} \tag{1.3}$$

$$= \int_{S} (\mathbf{F} \cdot \hat{\mathbf{n}}) \, \mathrm{d}a \tag{1.4}$$

$$= \int_{S} f_x \, \mathrm{d}y \, \mathrm{d}z + f_y \, \mathrm{d}z \, \mathrm{d}x + f_z \, \mathrm{d}x \, \mathrm{d}y \tag{1.5}$$

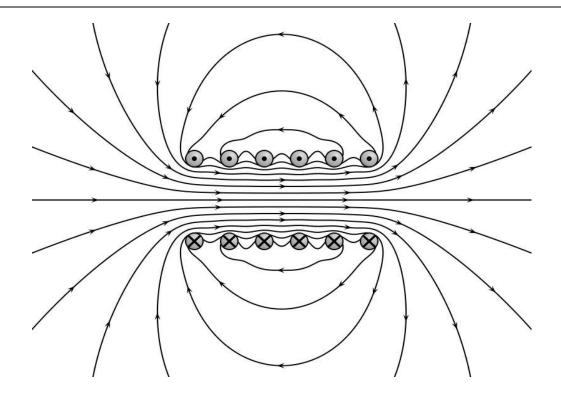
where  $\mathbf{a} \cdot \mathbf{b}$  is a dot product and  $\hat{\mathbf{n}}$  is a unit normal vector. If z = f(x, y), the da is given explicitly by

$$d\mathbf{a} = \pm \left( -\frac{\partial z}{\partial x} \hat{\mathbf{x}} - \frac{\partial z}{\partial y} \hat{\mathbf{y}} + \hat{\mathbf{z}} \right) dx dy$$
 (1.6)

If the surface is surface parameterized using u and v, then

$$\Phi = \int_{S} \mathbf{F} \cdot (\mathbf{T}_{u} \times \mathbf{T}_{v}) \, \mathrm{d}u \, \mathrm{d}v. \tag{1.7}$$

# Maxwell's Equations



## **Integral Form**

$$\iint_{\partial\Omega} \mathbf{E} \cdot d\mathbf{S} = \frac{1}{\varepsilon_0} \iiint_{\Omega} \rho \, dV \tag{2.1}$$

$$\iint_{\partial\Omega} \mathbf{B} \cdot d\mathbf{S} = 0 \tag{2.2}$$

$$\iint_{\partial\Omega} \mathbf{B} \cdot d\mathbf{S} = 0 \tag{2.2}$$

$$\oint_{\partial \Sigma} \mathbf{E} \cdot d\ell = -\frac{d}{dt} \iint_{\Sigma} \mathbf{B} \cdot d\mathbf{S}$$
(2.3)

$$\oint_{\partial \Sigma} \mathbf{B} \cdot d\ell = \mu_0 \iint_{\Sigma} \left( \mathbf{J} + \varepsilon_0 \frac{\partial \mathbf{E}}{\partial t} \right) \cdot d\mathbf{S}$$
(2.4)

#### Differential Form

$$\nabla \cdot \mathbf{E} = \frac{\rho}{\varepsilon_0}$$

$$\nabla \cdot \mathbf{B} = 0$$
(2.5)

$$\nabla \cdot \mathbf{B} = 0 \tag{2.6}$$

$$\nabla \times \mathbf{E} = -\frac{\partial \mathbf{B}}{\partial t} \tag{2.7}$$

$$\nabla \times \mathbf{E} = -\frac{\partial \mathbf{B}}{\partial t}$$

$$\nabla \times \mathbf{B} = \mu_0 \left( \mathbf{J} + \varepsilon_0 \frac{\partial \mathbf{E}}{\partial t} \right)$$
(2.8)

## **Grading Policies**

- 1. All project must be submitted electronically by 23:59:59 on the due date via TEACH use "Check time on server" if unsure about your clock. TEACH time takes priority over your local computer.
- 2. Only a single late homework assignment allowed. Only allowed up to 7 calendar days late.
- 3. Submit late homework to your assigned TA via email.
- 4. Blatant disrespect to or by the TAs will not be tolerated.
- 5. If you do not demo your project, you do not receive credit for it.
- 6. When you make an appointment to demo, show up. Failure to show up will result in a grade penalty. Repeated offenses will result in no credit for the assignment.
- 7. If your project does not compile, for any reason, no credit will be
- 8. Compilation will be on os-class. This server is the final say on whether your code compiles.
- 9. No directories in you submissions. You will be penalized for including any sort of hierarchy.
- 10. All assignments submitted to TEACH. No late submissions will be accepted via TEACH.
- 11. Naming convention: CS311\_proj $\langle x \rangle$ \_(engr\_username).tar.bz2. Fill in  $\langle \rangle$  with appropriate values.
- 12. No zip files will be accepted. You must use bzipped tar files.
- 13. All non-code documents must be created with LaTeX, by hand. This will be discussed in class.
- 14. All work must be done individually unless specifically allowed to work in groups.

## Learning Objectives

- Explain why multiprogramming is important for modern operating systems.
- Explain the general structure of a multiprogrammed operating system.
- Explain the purpose and operation of system calls.
- Write a program utilizing system calls.
- Write a program using a scripting language.
- Write a program that uses regular expressions to parse input data.
- Write a program that spawns processes and provides mutual exclusion for variables or other resources shared by the processes.
- Write a program that uses sockets to implement a client/server system.
- Explain how a common file system works, including structure, I/O operations, and security.
- Describe the memory organization of a typical process in a common operating system.