جامعة الموصل / كلية الهندسة

قسم الهندسة الكهربائية

Subject Title: Engineering mathematics (الرياضيات الهندسية)

Subject Code: ENGE 228

Class 2: power & electronic

Instructor : maha abdulrhman AL-Flaiyeh

Course Description (15 weeks) or Outlines

1. Function of two or more variable

- Limit & continuity
- Partial derivatives(definitions, function of more than two variable)
- Second order partial derivative
- Chain rule of functions of more than two variable
- Maxima and minima and saddle point

2. Multiple integral

- Double integral
- Properties of double integral
- Center of mass
- Double integral in polar coordinate
- Changing Cartesian integral to polar form

Course Description (15 weeks) or Outlines

- Triple integrals
- Evaluation of triple integral
- Triple integral in cylindrical coordinate
- Applications

3. Fourier analysis

- Trigonometric form of Fourier series
- Wave form symmetry
- Even and odd functions
- Half wave symmetry
- Sum and shift of function
- Complex exponential form of the Fourier series
- Fourier transformation

Course Description (15 weeks) or Outlines

4. Vector analysis

- Introduction to vectors ,vector algebra:addition,subtraction,multiplication
- Vector differential calculus: divertive ,gradient ,divergence, curl ,Eigen value &Eigen vector
- vectors

Figures, Diagrams, or Examples…. etc

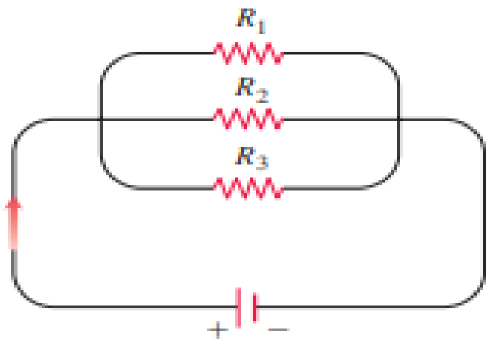


FIGURE 14.20 Resistors arranged this way are said to be connected in parallel (Example 7). Each resistor lets a portion of the current through. Their equivalent resistance R is calculated with the formula

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}.$$

EXAMPLE 7 If resistors of R_1, R_2, and R_3 ohms are connected in parallel to make an R-ohm resistor, the value of R can be found from the equation

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

(Figure 14.20). Find the value of $\partial R/\partial R_2$ when $R_1 = 30$, $R_2 = 45$, and $R_3 = 90$ ohms.

Solution To find $\partial R/\partial R_2$, we treat R_1 and R_3 as constants and, using implicit differentiation, differentiate both sides of the equation with respect to R_2:

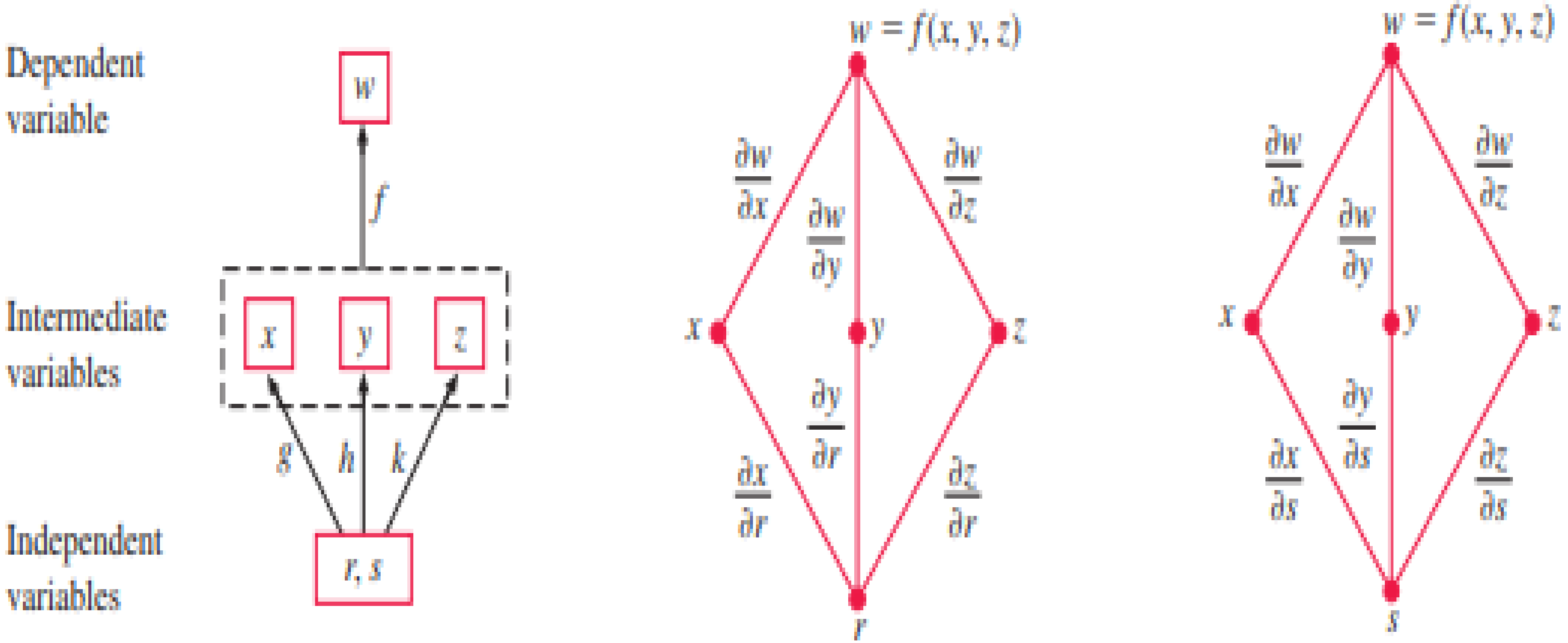
$$\frac{\partial}{\partial R_2}\left(\frac{1}{R}\right) = \frac{\partial}{\partial R_2}\left(\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}\right)$$

$$-\frac{1}{R^2}\frac{\partial R}{\partial R_2} = 0 - \frac{1}{{R_2}^2} + 0$$

$$\frac{\partial R}{\partial R_2} = \frac{R^2}{{R_2}^2} = \left(\frac{R}{R_2}\right)^2.$$

When $R_1 = 30$, $R_2 = 45$, and $R_3 = 90$,

$$\frac{1}{R} = \frac{1}{30} + \frac{1}{45} + \frac{1}{90} = \frac{3 + 2 + 1}{90} = \frac{6}{90} = \frac{1}{15},$$



$w = f(g(r, s), h(r, s), k(r, s))$

$$\frac{\partial w}{\partial r} = \frac{\partial w}{\partial x}\frac{\partial x}{\partial r} + \frac{\partial w}{\delta y}\frac{\partial y}{\partial r} + \frac{\partial w}{\partial z}\frac{\partial z}{\partial r}$$

$$\frac{\partial w}{\partial s} = \frac{\partial w}{\partial x}\frac{\partial x}{\partial s} + \frac{\partial w}{\partial y}\frac{\partial y}{\partial s} + \frac{\partial w}{\partial z}\frac{\partial z}{\partial s}$$

(a) (b) (c)

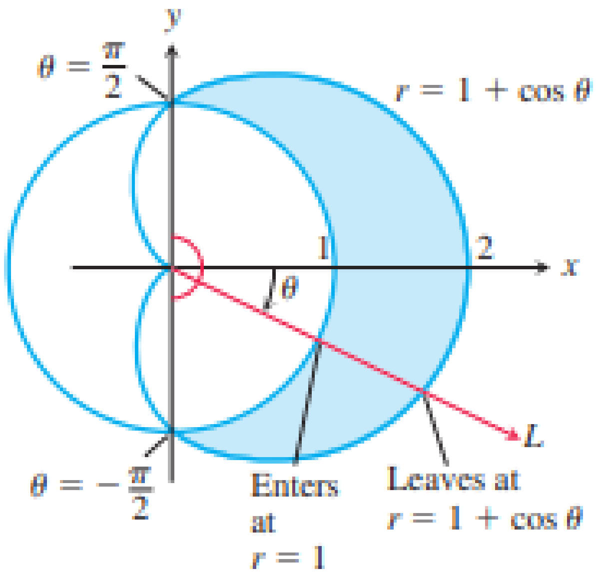


FIGURE 15.25 Finding the limits of integration in polar coordinates for the region in Example 1.

EXAMPLE 1 Find the limits of integration for integrating $f(r, \theta)$ over the region R that lies inside the cardioid $r = 1 + \cos\theta$ and outside the circle $r = 1$.

Solution

1. We first sketch the region and label the bounding curves (Figure 15.25).
2. Next we find the *r-limits of integration*. A typical ray from the origin enters R where $r = 1$ and leaves where $r = 1 + \cos\theta$.
3. Finally we find the *θ-limits of integration*. The rays from the origin that intersect R run from $\theta = -\pi/2$ to $\theta = \pi/2$. The integral is

$$\int_{-\pi/2}^{\pi/2}\int_{1}^{1+\cos\theta} f(r, \theta)\, r\, dr\, d\theta.$$

If $f(r, \theta)$ is the constant function whose value is 1, then the integral of f over R is the area of R.

Area Differential in Polar Coordinates

$$dA = r\, dr\, d\theta$$

Area in Polar Coordinates

The area of a closed and bounded region R in the polar coordinate plane is

$$A = \iint_R r\, dr\, d\theta.$$

Textbook or References

- Thomas' Calculus ,Early Transcendentals , Thirteenth Edition
- Advanced Engineering Mathematics ,Erwin Kreyszing ,tenth Edition

Useful Links

Description	Links
Video Lecture	https://www.youtube.com/watch?v=cFSRXum_3Es
Math and Science	https://www.youtube.com/watch?v=7iy83x8bv6o