Aplicação dos métodos de integração

José Douglas Gondim Soares[1] e Fernanda Costa de Sousa[2]

[1]douglasgondim@alu.ufc.br, 485347
[2]fernandacosta@alu.ufc.br, 485404

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1 Aplicação dos métodos de integração:

$A = \int g(x, y) dA$

$A = 4 \int g(x, y) dx dy$

$f(x, y) = 0.2(x^2 - y^2)$

$\frac{df}{dx} = 0.4x \quad \frac{df}{dy} = -0.4y$

$g(x, y) = \sqrt{0.16x^2 + 0.16y^2 + 1}$

$A_1 = \int_0^{40} \int_0^{\sqrt{40^2 - x^2}} dy \, dx$

$\begin{cases} x = \rho R cos(\theta) \\ y = \rho R sen(\theta) \end{cases}$

$= \int_0^1 \int_0^{\frac{\pi}{2}} g(\rho R cos\theta, \rho R sen\theta) |J_1| d\rho d\theta$

$J_1 = \begin{vmatrix} R cos\theta & -\rho R sen\theta \\ R sen\theta & \rho R cos\theta \end{vmatrix} = \rho R^2 (cos^2\theta + sen^2\theta) = \rho R^2$

$A_1 = \int_0^1 \int_0^{\frac{\pi}{2}} g(x(\rho, \theta), y(\rho, \theta)) \rho R^2 \, d\theta d\rho =$

$\int_{-1}^1 \int_{-1}^1 g(x(\rho(s, t), \theta(s, t)), y(\rho(s, t), \theta(s, t))) \, \rho R^2 |J_2| \, ds \, dt$

$J_2 = \begin{vmatrix} \frac{1}{2} & 0 \\ 0 & \frac{\pi}{4} \end{vmatrix} = \frac{\pi}{8}$

$\rho = \frac{0+1}{2} + \frac{1-0}{2}s = \frac{1}{2} + \frac{s}{2}$

$\theta = \frac{0+\frac{\pi}{2}}{2} + \frac{\frac{\pi}{2}-0}{2}t = \frac{\pi}{4} + \frac{\pi}{4}t$

$s = -\sqrt{\frac{3}{5}}, 0, \sqrt{\frac{3}{5}} \text{ e } t = -\sqrt{\frac{3}{5}}, 0, \sqrt{\frac{3}{5}}$

$A = \int_{-1}^1 \int_{-1}^1 \hat{g}(s, t) \, ds dt = \int_{-1}^1 \int_{-1}^1 \sqrt{0.16x^2 + 0.16y^2 + 1} \, \rho R^2 \frac{\pi}{8} =$

$\sum \sum w_s w_t \, \hat{g}(s, t)$