

[2]

(1)

$$\begin{aligned} \text{rot } A &= \left(\frac{\partial}{\partial y} (y-x) - \frac{\partial}{\partial z} (x-z), \frac{\partial}{\partial z} (z-y) - \frac{\partial}{\partial x} (y-x), \frac{\partial}{\partial x} (x-z) - \frac{\partial}{\partial y} (x-y) \right) \\ &= (1+1, 1+1, 1+1) = (2, 2, 2) \end{aligned}$$

(2)

$$A = (-b \sin \theta, a \cos \theta, b \sin \theta - a \cos \theta)$$

$$\frac{dH}{d\theta} = (-a \sin \theta, b \cos \theta, 0)$$

$$\begin{aligned} \int_C A \, dH &= \int_0^{2\pi} A \frac{dH}{d\theta} \, d\theta \\ &= \int_0^{2\pi} (ab \sin^2 \theta + ab \cos^2 \theta) \, d\theta \\ &= \int_0^{2\pi} ab \, d\theta = 2\pi ab \end{aligned}$$

(3)

$$\frac{\partial H}{\partial \theta} = (-a(1-t) \sin \theta, b(1-t) \cos \theta, 0)$$

$$\frac{\partial H}{\partial t} = (-a \cos \theta, -b \sin \theta, 1)$$

$$\begin{aligned} \frac{\partial H}{\partial \theta} \times \frac{\partial H}{\partial t} &= (b(1-t) \cos \theta, a(1-t) \sin \theta, ab(1-t) \sin^2 \theta + ab(1-t) \cos^2 \theta) \\ &= (b(1-t) \cos \theta, a(1-t) \sin \theta, ab(1-t)) \end{aligned}$$

$$\left| \frac{\partial H}{\partial \theta} \times \frac{\partial H}{\partial t} \right| = (1-t) \sqrt{b^2 \cos^2 \theta + a^2 \sin^2 \theta + a^2 b^2}$$

$$\eta = \frac{\frac{\partial H}{\partial \theta} \times \frac{\partial H}{\partial t}}{\left| \frac{\partial H}{\partial \theta} \times \frac{\partial H}{\partial t} \right|} = \frac{1}{\sqrt{b^2 \cos^2 \theta + a^2 \sin^2 \theta + a^2 b^2}} (b \cos \theta, a \sin \theta, ab)$$