APPENDIX A

If

$$B = \hat{x}b_1 + \hat{y}b_2 + \hat{z}b_3 \tag{B.1}$$

and

$$A = \hat{x}a_1 + \hat{y}a_2 + \hat{z}a_3 \tag{B.2}$$

and using Eq. (6.2) we get

$$\frac{\partial a_3}{\partial y} - \frac{\partial a_2}{\partial z} = b_1 \qquad \text{(B.3a)}$$

$$\frac{\partial a_1}{\partial z} - \frac{\partial a_3}{\partial x} = b_2 \qquad \text{(B.3a)}$$

$$\frac{\partial a_2}{\partial x} - \frac{\partial a_1}{\partial y} = b_3 \qquad \text{(B.3c)}$$

Assuming that the coordinates have been chosen as A is parallel to the yz-plan, i.e. a_1=0, then

$$\begin{aligned} b_2 &= -\frac{\partial a_3}{\partial x} \\ b_3 &= \frac{\partial a_2}{\partial x} \end{aligned} \tag{B.4}$$

Integrating, we get

$$a_2 = \int_{x_0}^{x} b_3 dx + f_2(y,z)$$
$$a_3 = -\int_{x_0}^{x} b_2 dx + f_3(y,z) \tag{B.5}$$

where f_2, f_3 are arbitrary functions of y and z.

Using Eqn. (B.5) on Eqn. (B.3a) we get

$$\frac{\partial a_3}{\partial y} - \frac{\partial a_2}{\partial z} = \int_{x_0}^{x} \frac{\partial b_1}{\partial x} dx + \frac{\partial f_3}{\partial y} - \frac{\partial f_2}{\partial z} \tag{B.6}$$

Integrating with respect to x, we get

$$\frac{\partial a_3}{\partial y} - \frac{\partial a_2}{\partial z} = b_1(x,y,z) - b_1(x_0,y,z) + \frac{\partial f_3}{\partial y} - \frac{\partial f_2}{\partial z} \tag{B.7}$$

Since f_1 and f_2 are arbitrary functions of y and z, we can choose

$$f_2 = 0$$
$$f_3 = \int_{y_0}^{y} b_1(x_0,y,z) dy \tag{B.8}$$

Hence we can write

$$A = \hat{y}\int_{x_0}^{x} b_3(x,y,z) dx + \hat{z}\left[\int_{y_0}^{y} b_1(x_0,y,z) dy - \int_{x_0}^{x} b_2(x,y,z) dx\right] \tag{B.9}$$

In case of a constant magnetic induction

$$B = \hat{z}B_z \tag{B.10}$$

where B_z is a constant, then Eqn's. (B.3a), (B.3b), (B.3c) becomes

$$\frac{\partial a_3}{\partial y} - \frac{\partial a_2}{\partial z} = 0 \tag{B.11a}$$

$$\frac{\partial a_1}{\partial z} - \frac{\partial a_3}{\partial x} = 0 \tag{B.11b}$$

$$\frac{\partial a_2}{\partial x} - \frac{\partial a_1}{\partial y} = B_z \tag{B.11c}$$

When a_1=0, Eqn. (7.9) becomes

$$A = \hat{y}\int_{x_0}^{x} B_z dx = \hat{y}Bx \tag{B.12}$$