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(%i18) kill(all);
(%o0) done
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1 Eq. (10)

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(%i1) L1: matrix([gamma,0,0,-beta*gamma],
[0,1,0,0],
[0,0,1,0],
[-beta*gamma,0,0,gamma]);
(%o1) 
$$\begin{bmatrix} \Gamma & 0 & 0 & -beta \Gamma \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ -beta \Gamma & 0 & 0 & \Gamma \end{bmatrix}$$

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2 Transformation in Z direction

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(%i2) J4: transpose([c*rho, J[x], J[y], J[z]]);
(%o2) 
$$\begin{bmatrix} c \rho \\ J_x \\ J_y \\ J_z \end{bmatrix}$$

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(%i3) LJ: factor(L1.J4);
(%o3) 
$$\begin{bmatrix} -(beta J_z - c \rho) \Gamma \\ J_x \\ J_y \\ (J_z - beta c \rho) \Gamma \end{bmatrix}$$

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(%i4) A4: transpose([phi/c, A[x], A[y], A[z]]);
(%o4) 
$$\begin{bmatrix} \frac{\phi}{c} \\ A_x \\ A_y \\ A_z \end{bmatrix}$$

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(%i5) LA: factor(L1.A4);

(%o5)

$$\begin{bmatrix} \frac{(beta\ c\ A_z - \phi)\ \Gamma}{c} \\ A_x \\ A_y \\ \frac{(c\ A_z - beta\ \phi)\ \Gamma}{c} \end{bmatrix}$$

3 Transformation in general direction

(%i6) Lambda: matrix([gamma, -gamma*b[x], -gamma*b[y], -gamma*b[z]],
[-gamma*b[x], 1+(gamma-1)*(b[x]/b[0])^2, (gamma-1)*b[x]*b[y]/b[0]^2,
(gamma-1)*b[x]*b[z]/b[0]^2,
[-gamma*b[y], (gamma-1)*b[y]*b[x]/b[0]^2, 1+(gamma-1)*(b[y]/b[0])^2,
(gamma-1)*b[y]*b[z]/b[0]^2,
[-gamma*b[z], (gamma-1)*b[x]*b[z]/b[0]^2, (gamma-1)*b[z]*b[y]/b[0]^2,
1+(gamma-1)*(b[z]/b[0])^2]);

(%o6)

$$\begin{bmatrix} \Gamma & -b_x \Gamma & -b_y \Gamma & -b_z \Gamma \\ -b_x \Gamma & \frac{b_x^2 (\Gamma - 1)}{b_0^2} + 1 & \frac{b_x b_y (\Gamma - 1)}{b_0^2} & \frac{b_x b_z (\Gamma - 1)}{b_0^2} \\ -b_y \Gamma & \frac{b_x b_y (\Gamma - 1)}{b_0^2} & \frac{b_y^2 (\Gamma - 1)}{b_0^2} + 1 & \frac{b_y b_z (\Gamma - 1)}{b_0^2} \\ -b_z \Gamma & \frac{b_x b_z (\Gamma - 1)}{b_0^2} & \frac{b_y b_z (\Gamma - 1)}{b_0^2} & \frac{b_z^2 (\Gamma - 1)}{b_0^2} + 1 \end{bmatrix}$$

(%i7) J4: transpose([c*rho, J[x], J[y], J[z]]);

(%o7)

$$\begin{bmatrix} c\ \rho \\ J_x \\ J_y \\ J_z \end{bmatrix}$$

(%i8) LJ: (Lambda.transpose(J4));

(%o8)

$$\begin{bmatrix} -b_z J_z \Gamma - b_y J_y \Gamma - b_x J_x \Gamma + c\ \rho\ \Gamma \\ -c\ \rho\ b_x \Gamma + \frac{b_x b_z J_z (\Gamma - 1)}{b_0^2} + \frac{b_x b_y J_y (\Gamma - 1)}{b_0^2} + J_x \left(\frac{b_x^2 (\Gamma - 1)}{b_0^2} + 1 \right) \\ -c\ \rho\ b_y \Gamma + \frac{b_y b_z J_z (\Gamma - 1)}{b_0^2} + \frac{b_x J_x b_y (\Gamma - 1)}{b_0^2} + J_y \left(\frac{b_y^2 (\Gamma - 1)}{b_0^2} + 1 \right) \\ -c\ \rho\ b_z \Gamma + \frac{b_y J_y b_z (\Gamma - 1)}{b_0^2} + \frac{b_x J_x b_z (\Gamma - 1)}{b_0^2} + J_z \left(\frac{b_z^2 (\Gamma - 1)}{b_0^2} + 1 \right) \end{bmatrix}$$

(%i9) A4: transpose([phi/c, A[x], A[y], A[z]]);

(%o9)

$$\begin{bmatrix} \frac{\phi}{c} \\ A_x \\ A_y \\ A_z \end{bmatrix}$$

(%i10) LA: (Lambda.A4);

(%o10)

$$\begin{bmatrix} -b_z A_z \Gamma - b_y A_y \Gamma - b_x A_x \Gamma + \frac{\phi \Gamma}{c} \\ -\frac{\phi b_x \Gamma}{c} + \frac{b_x b_z A_z (\Gamma - 1)}{b_0^2} + \frac{b_x b_y A_y (\Gamma - 1)}{b_0^2} + A_x \left(\frac{b_x^2 (\Gamma - 1)}{b_0^2} + 1 \right) \\ -\frac{\phi b_y \Gamma}{c} + \frac{b_y b_z A_z (\Gamma - 1)}{b_0^2} + \frac{b_x A_x b_y (\Gamma - 1)}{b_0^2} + A_y \left(\frac{b_y^2 (\Gamma - 1)}{b_0^2} + 1 \right) \\ -\frac{\phi b_z \Gamma}{c} + \frac{b_y A_y b_z (\Gamma - 1)}{b_0^2} + \frac{b_x A_x b_z (\Gamma - 1)}{b_0^2} + A_z \left(\frac{b_z^2 (\Gamma - 1)}{b_0^2} + 1 \right) \end{bmatrix}$$