$\boldsymbol{A} = A + A^{x}\boldsymbol{e}_{x} + A^{y}\boldsymbol{e}_{y} + A^{z}\boldsymbol{e}_{z} + A^{xy}\boldsymbol{e}_{x}\wedge\boldsymbol{e}_{y} + A^{xz}\boldsymbol{e}_{x}\wedge\boldsymbol{e}_{z} + A^{yz}\boldsymbol{e}_{y}\wedge\boldsymbol{e}_{z} + A^{xyz}\boldsymbol{e}_{x}\wedge\boldsymbol{e}_{y}\wedge\boldsymbol{e}_{z}$

$\boldsymbol{A} = A^{x}\boldsymbol{e}_{x} + A^{y}\boldsymbol{e}_{y} + A^{z}\boldsymbol{e}_{z}$

$\boldsymbol{B} = B^{xy}\boldsymbol{e}_{x}\wedge\boldsymbol{e}_{y} + B^{xz}\boldsymbol{e}_{x}\wedge\boldsymbol{e}_{z} + B^{yz}\boldsymbol{e}_{y}\wedge\boldsymbol{e}_{z}$

$\boldsymbol{\nabla} f = \partial_{x} f\boldsymbol{e}_{x} + \partial_{y} f\boldsymbol{e}_{y} + \partial_{z} f\boldsymbol{e}_{z}$

$\boldsymbol{\nabla}\cdot\boldsymbol{A} = \partial_{x} A^{x} + \partial_{y} A^{y} + \partial_{z} A^{z}$

$\boldsymbol{\nabla}\boldsymbol{A} = \left(\partial_{x} A^{x} + \partial_{y} A^{y} + \partial_{z} A^{z}\right) + \left(-\partial_{y} A^{x} + \partial_{x} A^{y}\right)\boldsymbol{e}_{x}\wedge\boldsymbol{e}_{y} + \left(-\partial_{z} A^{x} + \partial_{x} A^{z}\right)\boldsymbol{e}_{x}\wedge\boldsymbol{e}_{z} + \left(-\partial_{z} A^{y} + \partial_{y} A^{z}\right)\boldsymbol{e}_{y}\wedge\boldsymbol{e}_{z}$

$-I(\boldsymbol{\nabla}\wedge\boldsymbol{A}) = \left(-\partial_{z} A^{y} + \partial_{y} A^{z}\right)\boldsymbol{e}_{x} + \left(\partial_{z} A^{x} - \partial_{x} A^{z}\right)\boldsymbol{e}_{y} + \left(-\partial_{y} A^{x} + \partial_{x} A^{y}\right)\boldsymbol{e}_{z}$

$\boldsymbol{\nabla}\boldsymbol{B} = \left(-\partial_{y} B^{xy} - \partial_{z} B^{xz}\right)\boldsymbol{e}_{x} + \left(\partial_{x} B^{xy} - \partial_{z} B^{yz}\right)\boldsymbol{e}_{y} + \left(\partial_{x} B^{xz} + \partial_{y} B^{yz}\right)\boldsymbol{e}_{z} + \left(\partial_{z} B^{xy} - \partial_{y} B^{xz} + \partial_{x} B^{yz}\right)\boldsymbol{e}_{x}\wedge\boldsymbol{e}_{y}\wedge\boldsymbol{e}_{z}$

$\boldsymbol{\nabla}\wedge\boldsymbol{B} = \left(\partial_{z} B^{xy} - \partial_{y} B^{xz} + \partial_{x} B^{yz}\right)\boldsymbol{e}_{x}\wedge\boldsymbol{e}_{y}\wedge\boldsymbol{e}_{z}$

$\boldsymbol{\nabla}\cdot\boldsymbol{B} = \left(-\partial_{y} B^{xy} - \partial_{z} B^{xz}\right)\boldsymbol{e}_{x} + \left(\partial_{x} B^{xy} - \partial_{z} B^{yz}\right)\boldsymbol{e}_{y} + \left(\partial_{x} B^{xz} + \partial_{y} B^{yz}\right)\boldsymbol{e}_{z}$

$g_{ij} = \begin{bmatrix} (a\cdot a) & (a\cdot b) & (a\cdot c) & (a\cdot d) \\ (a\cdot b) & (b\cdot b) & (b\cdot c) & (b\cdot d) \\ (a\cdot c) & (b\cdot c) & (c\cdot c) & (c\cdot d) \\ (a\cdot d) & (b\cdot d) & (c\cdot d) & (d\cdot d) \end{bmatrix}$

$\boldsymbol{a\cdot (bc)} = -\left(a\cdot c\right)\boldsymbol{b} + \left(a\cdot b\right)\boldsymbol{c}$

$\boldsymbol{a\cdot (b\wedge c)} = -\left(a\cdot c\right)\boldsymbol{b} + \left(a\cdot b\right)\boldsymbol{c}$

$\boldsymbol{a\cdot (b\wedge c\wedge d)} = \left(a\cdot d\right)\boldsymbol{b}\wedge\boldsymbol{c} - \left(a\cdot c\right)\boldsymbol{b}\wedge\boldsymbol{d} + \left(a\cdot b\right)\boldsymbol{c}\wedge\boldsymbol{d}$

$\boldsymbol{a\cdot (b\wedge c) + c\cdot (a\wedge b) + b\cdot (c\wedge a)} = 0$

$\boldsymbol{a(b\wedge c) - b(a\wedge c) + c(a\wedge b)} = 3\boldsymbol{a}\wedge\boldsymbol{b}\wedge\boldsymbol{c}$

$\boldsymbol{a(b\wedge c\wedge d) - b(a\wedge c\wedge d) + c(a\wedge b\wedge d) - d(a\wedge b\wedge c)} = 4\boldsymbol{a}\wedge\boldsymbol{b}\wedge\boldsymbol{c}\wedge\boldsymbol{d}$

$\boldsymbol{(a\wedge b)\cdot (c\wedge d)} = -\left(a\cdot c\right)\left(b\cdot d\right) + \left(a\cdot d\right)\left(b\cdot c\right)$

$\boldsymbol{((a\wedge b)\cdot c)\cdot d} = -\left(a\cdot c\right)\left(b\cdot d\right) + \left(a\cdot d\right)\left(b\cdot c\right)$

$\boldsymbol{(a\wedge b)\times (c\wedge d)} = -\left(b\cdot d\right)\boldsymbol{a}\wedge\boldsymbol{c} + \left(b\cdot c\right)\boldsymbol{a}\wedge\boldsymbol{d} + \left(a\cdot d\right)\boldsymbol{b}\wedge\boldsymbol{c} - \left(a\cdot c\right)\boldsymbol{b}\wedge\boldsymbol{d}$

$E = \boldsymbol{e}_{1}\wedge\boldsymbol{e}_{2}\wedge\boldsymbol{e}_{3}$

$E^{2} = \left(e_{1}\cdot e_{2}\right)^{2} - 2\left(e_{1}\cdot e_{2}\right)\left(e_{1}\cdot e_{3}\right)\left(e_{2}\cdot e_{3}\right) + \left(e_{1}\cdot e_{3}\right)^{2} + \left(e_{2}\cdot e_{3}\right)^{2} - 1$

$E1 = (e2\wedge e3)E = \left(\left(e_{2}\cdot e_{3}\right)^{2} - 1\right)\boldsymbol{e}_{1} + \left(\left(e_{1}\cdot e_{2}\right) - \left(e_{1}\cdot e_{3}\right)\left(e_{2}\cdot e_{3}\right)\right)\boldsymbol{e}_{2} + \left(-\left(e_{1}\cdot e_{2}\right)\left(e_{2}\cdot e_{3}\right) + \left(e_{1}\cdot e_{3}\right)\right)\boldsymbol{e}_{3}$

$E2 = -(e1\wedge e3)E = \left(\left(e_{1}\cdot e_{2}\right) - \left(e_{1}\cdot e_{3}\right)\left(e_{2}\cdot e_{3}\right)\right)\boldsymbol{e}_{1} + \left(\left(e_{1}\cdot e_{3}\right)^{2} - 1\right)\boldsymbol{e}_{2} + \left(-\left(e_{1}\cdot e_{2}\right)\left(e_{1}\cdot e_{3}\right) + \left(e_{2}\cdot e_{3}\right)\right)\boldsymbol{e}_{3}$

$E3 = (e1\wedge e2)E = \left(-\left(e_{1}\cdot e_{2}\right)\left(e_{2}\cdot e_{3}\right) + \left(e_{1}\cdot e_{3}\right)\right)\boldsymbol{e}_{1} + \left(-\left(e_{1}\cdot e_{2}\right)\left(e_{1}\cdot e_{3}\right) + \left(e_{2}\cdot e_{3}\right)\right)\boldsymbol{e}_{2} + \left(\left(e_{1}\cdot e_{2}\right)^{2} - 1\right)\boldsymbol{e}_{3}$

$E1\cdot e2 = 0$

$E1\cdot e3 = 0$

$E2\cdot e1 = 0$

$E2\cdot e3 = 0$

$E3\cdot e1 = 0$

$E3\cdot e2 = 0$

$(E1\cdot e1)/E^{2} = 1$

$(E2\cdot e2)/E^{2} = 1$

$(E3\cdot e3)/E^{2} = 1$

$A = A^{r}\boldsymbol{e}_{r} + A^{\theta}\boldsymbol{e}_{\theta} + A^{\phi}\boldsymbol{e}_{\phi}$

$B = B^{r\theta}\boldsymbol{e}_{r}\wedge\boldsymbol{e}_{\theta} + B^{r\phi}\boldsymbol{e}_{r}\wedge\boldsymbol{e}_{\phi} + B^{\phi\phi}\boldsymbol{e}_{\theta}\wedge\boldsymbol{e}_{\phi}$

$$\boldsymbol{\nabla} f = \partial_{r} f \boldsymbol{e}_{r} + \frac{1}{r} \partial_{\theta} f \boldsymbol{e}_{\theta} + \frac{\partial_{\phi} f}{r \sin{\left(\theta \right)}} \boldsymbol{e}_{\phi}$$

$$\boldsymbol{\nabla} \cdot A = \frac{1}{r} \left(r \partial_{r} A^{r} + 2 A^{r} + \frac{A^{\theta}}{\tan{\left(\theta \right)}} + \partial_{\theta} A^{\theta} + \frac{\partial_{\phi} A^{\phi}}{\sin{\left(\theta \right)}}\right)$$

$$-I (\boldsymbol{\nabla} \wedge A) = \frac{1}{r} \left(\frac{A^{\phi}}{\tan{\left(\theta \right)}} + \partial_{\theta} A^{\phi} - \frac{\partial_{\phi} A^{\theta}}{\sin{\left(\theta \right)}}\right) \boldsymbol{e}_{r} + \frac{1}{r} \left(- r \partial_{r} A^{\phi} - A^{\phi} + \frac{\partial_{\phi} A^{r}}{\sin{\left(\theta \right)}}\right) \boldsymbol{e}_{\theta} + \frac{1}{r} \left(r \partial_{r} A^{\theta} + A^{\theta} - \partial_{\theta} A^{r}\right) \boldsymbol{e}_{\phi}$$

$$\boldsymbol{\nabla} \wedge B = \frac{1}{r} \left(r \partial_{r} B^{\phi\phi} - \frac{B^{r\phi}}{\tan{\left(\theta \right)}} + 2 B^{\phi\phi} - \partial_{\theta} B^{r\phi} + \frac{\partial_{\phi} B^{r\theta}}{\sin{\left(\theta \right)}}\right) \boldsymbol{e}_{r}\wedge \boldsymbol{e}_{\theta}\wedge \boldsymbol{e}_{\phi}$$

$$B = \boldsymbol{B\gamma_t} = - B^{x} \boldsymbol{\gamma}_{t}\wedge \boldsymbol{\gamma}_{x} - B^{y} \boldsymbol{\gamma}_{t}\wedge \boldsymbol{\gamma}_{y} - B^{z} \boldsymbol{\gamma}_{t}\wedge \boldsymbol{\gamma}_{z}$$

$$E = \boldsymbol{E\gamma_t} = - E^{x} \boldsymbol{\gamma}_{t}\wedge \boldsymbol{\gamma}_{x} - E^{y} \boldsymbol{\gamma}_{t}\wedge \boldsymbol{\gamma}_{y} - E^{z} \boldsymbol{\gamma}_{t}\wedge \boldsymbol{\gamma}_{z}$$

$$F = E+IB = - E^{x} \boldsymbol{\gamma}_{t}\wedge \boldsymbol{\gamma}_{x} - E^{y} \boldsymbol{\gamma}_{t}\wedge \boldsymbol{\gamma}_{y} - E^{z} \boldsymbol{\gamma}_{t}\wedge \boldsymbol{\gamma}_{z} - B^{z} \boldsymbol{\gamma}_{x}\wedge \boldsymbol{\gamma}_{y} + B^{y} \boldsymbol{\gamma}_{x}\wedge \boldsymbol{\gamma}_{z} - B^{x} \boldsymbol{\gamma}_{y}\wedge \boldsymbol{\gamma}_{z}$$

$$J = J^{t} \boldsymbol{\gamma}_{t} + J^{x} \boldsymbol{\gamma}_{x} + J^{y} \boldsymbol{\gamma}_{y} + J^{z} \boldsymbol{\gamma}_{z}$$

$$\boldsymbol{\nabla} F = J$$

$$R = \cosh{\left(\frac{\alpha}{2} \right)} + \sinh{\left(\frac{\alpha}{2} \right)}\boldsymbol{\gamma}_{t}\wedge \boldsymbol{\gamma}_{x}$$

$$t\boldsymbol{\gamma_t}+x\boldsymbol{\gamma_x} = t'\boldsymbol{\gamma'_t}+x'\boldsymbol{\gamma'_x} = R\left(t'\boldsymbol{\gamma_t}+x'\boldsymbol{\gamma_x}\right)R^{\dagger}$$

$$t\boldsymbol{\gamma_t}+x\boldsymbol{\gamma_x} = \left(t' \cosh{\left(\alpha \right)} - x' \sinh{\left(\alpha \right)}\right) \boldsymbol{\gamma}_{t} + \left(- t' \sinh{\left(\alpha \right)} + x' \cosh{\left(\alpha \right)}\right) \boldsymbol{\gamma}_{x}$$

$$\sinh{\left(\alpha \right)} = \gamma\beta$$

$$\cosh{\left(\alpha \right)} = \gamma$$

$$t\boldsymbol{\gamma_t}+x\boldsymbol{\gamma_x} = \gamma \left(- \beta x' + t'\right) \boldsymbol{\gamma}_{t} + \gamma \left(- \beta t' + x'\right) \boldsymbol{\gamma}_{x}$$

$$\boldsymbol{A} = A^{t} \boldsymbol{\gamma}_{t} + A^{x} \boldsymbol{\gamma}_{x} + A^{y} \boldsymbol{\gamma}_{y} + A^{z} \boldsymbol{\gamma}_{z}$$

$$\boldsymbol{\psi} = \psi + \psi^{tx} \boldsymbol{\gamma}_{t}\wedge \boldsymbol{\gamma}_{x} + \psi^{ty} \boldsymbol{\gamma}_{t}\wedge \boldsymbol{\gamma}_{y} + \psi^{tz} \boldsymbol{\gamma}_{t}\wedge \boldsymbol{\gamma}_{z} + \psi^{xy} \boldsymbol{\gamma}_{x}\wedge \boldsymbol{\gamma}_{y} + \psi^{xz} \boldsymbol{\gamma}_{x}\wedge \boldsymbol{\gamma}_{z} + \psi^{yz} \boldsymbol{\gamma}_{y}\wedge \boldsymbol{\gamma}_{z} + \psi^{txyz} \boldsymbol{\gamma}_{t}\wedge \boldsymbol{\gamma}_{x}\wedge \boldsymbol{\gamma}_{y}\wedge \boldsymbol{\gamma}_{z}$$