$$g_{ij} = \begin{bmatrix} (e_x \cdot e_x) & (e_x \cdot e_y) & (e_x \cdot e_z) \\ (e_x \cdot e_y) & (e_y \cdot e_y) & (e_y \cdot e_z) \\ (e_x \cdot e_z) & (e_y \cdot e_z) & (e_z \cdot e_z) \end{bmatrix}$$

$$A = A + A^x e_x + A^y e_y + A^z e_z + A^{xy} e_x \wedge e_y + A^{xz} e_x \wedge e_z + A^{yz} e_y \wedge e_z + A^{xyz} e_x \wedge e_y \wedge e_z$$

$$A = A$$

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

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

$$+ A^{xyz} \mathbf{e}_{x} \wedge \mathbf{e}_{y} \wedge \mathbf{e}_{z}$$

$$A = A$$

$$+A^{x}e_{x}$$

$$+A^{y}e_{y}$$

$$+A^{z}e_{z}$$

$$+A^{xy}e_x\wedge e_y$$

$$+A^{xz}e_x\wedge e_z$$

$$+A^{yz}e_y\wedge e_z$$

$$+A^{xyz}e_x\wedge e_y\wedge e_z$$

$$A_{+} = A + A^{xy} \mathbf{e}_x \wedge \mathbf{e}_y + A^{xz} \mathbf{e}_x \wedge \mathbf{e}_z + A^{yz} \mathbf{e}_y \wedge \mathbf{e}_z$$

$$A_{-} = A^{x} \mathbf{e}_{x} + A^{y} \mathbf{e}_{y} + A^{z} \mathbf{e}_{z} + A^{xyz} \mathbf{e}_{x} \wedge \mathbf{e}_{y} \wedge \mathbf{e}_{z}$$

$$X = X^x \mathbf{e}_x + X^y \mathbf{e}_y + X^z \mathbf{e}_z$$

$$Y = Y^x \mathbf{e}_x + Y^y \mathbf{e}_y + Y^z \mathbf{e}_z$$

$$XY = ((e_x \cdot e_x) X^x Y^x + (e_x \cdot e_y) X^x Y^y + (e_x \cdot e_y) X^y Y^x + (e_x \cdot e_z) X^x Y^z + (e_x \cdot e_z) X^z Y^x + (e_y \cdot e_y) X^y Y^y + (e_y \cdot e_z) X^z Y^z + (e_y \cdot e_z) X^z Y^y + (e_z \cdot e_z) X^z Y^z + (e_y \cdot e_z) X^$$

$$X \wedge Y = (X^xY^y - X^yY^x) \mathbf{e}_x \wedge \mathbf{e}_y + (X^xY^z - X^zY^x) \mathbf{e}_x \wedge \mathbf{e}_z + (X^yY^z - X^zY^y) \mathbf{e}_y \wedge \mathbf{e}_z$$

$$X \cdot Y = (e_x \cdot e_x) X^x Y^x + (e_x \cdot e_y) X^x Y^y + (e_x \cdot e_y) X^y Y^x + (e_x \cdot e_z) X^x Y^z + (e_x \cdot e_z) X^z Y^x + (e_y \cdot e_y) X^y Y^y + (e_y \cdot e_z) X^z Y^z + (e_y \cdot e_z) X^z Y^z + (e_x \cdot e_z)$$

$$g_{ij} = \begin{bmatrix} (e_x \cdot e_x) & (e_x \cdot e_y) \\ (e_x \cdot e_y) & (e_y \cdot e_y) \end{bmatrix}$$

$$X = X^x e_x + X^y e_y$$

$$A = A + A^{xy} \boldsymbol{e}_x \wedge \boldsymbol{e}_y$$

$$X \cdot A = -A^{xy} \left(\left(e_x \cdot e_y \right) X^x + \left(e_y \cdot e_y \right) X^y \right) \boldsymbol{e}_x + A^{xy} \left(\left(e_x \cdot e_x \right) X^x + \left(e_x \cdot e_y \right) X^y \right) \boldsymbol{e}_y$$

$$X\rfloor A = -A^{xy}\left(\left(e_x\cdot e_y\right)X^x + \left(e_y\cdot e_y\right)X^y\right)\boldsymbol{e}_x + A^{xy}\left(\left(e_x\cdot e_x\right)X^x + \left(e_x\cdot e_y\right)X^y\right)\boldsymbol{e}_y$$

$$A[X = A^{xy}((e_x \cdot e_y) X^x + (e_y \cdot e_y) X^y) \mathbf{e}_x - A^{xy}((e_x \cdot e_x) X^x + (e_x \cdot e_y) X^y) \mathbf{e}_y$$