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

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

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

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

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

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

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

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

$$\begin{aligned} XY = & \left(X^{x}Y^{x} \left(e_x \cdot e_x\right) + X^{x}Y^{y} \left(e_x \cdot e_y\right) + X^{x}Y^{z} \left(e_x \cdot e_z\right) + X^{y}Y^{x} \left(e_x \cdot e_y\right) + X^{y}Y^{y} \left(e_y \cdot e_y\right) + X^{y}Y^{z} \left(e_y \cdot e_z\right) + X^{z}Y^{x} \left(e_x \cdot e_z\right) + X^{z}Y^{y} \left(e_y \cdot e_z\right) + X^{z}Y^{z} \left(e_z \cdot e_z\right)\right) \\ & + \left(X^{x}Y^{y} - X^{y}Y^{x}\right) \boldsymbol{e}_{x}\wedge \boldsymbol{e}_{y} + \left(X^{x}Y^{z} - X^{z}Y^{x}\right) \boldsymbol{e}_{x}\wedge \boldsymbol{e}_{z} + \left(X^{y}Y^{z} - X^{z}Y^{y}\right) \boldsymbol{e}_{y}\wedge \boldsymbol{e}_{z} \end{aligned}$$

$$X\wedge Y = \left(X^{x}Y^{y} - X^{y}Y^{x}\right) \boldsymbol{e}_{x}\wedge \boldsymbol{e}_{y} + \left(X^{x}Y^{z} - X^{z}Y^{x}\right) \boldsymbol{e}_{x}\wedge \boldsymbol{e}_{z} + \left(X^{y}Y^{z} - X^{z}Y^{y}\right) \boldsymbol{e}_{y}\wedge \boldsymbol{e}_{z}$$

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

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

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

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

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

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

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