$$A = \begin{bmatrix} A_{11} & A_{12} \\ A_{21} & A_{22} \end{bmatrix}, B = \begin{bmatrix} B_{11} & B_{12} \\ B_{21} & B_{22} \end{bmatrix}, C = \begin{bmatrix} C_{11} & C_{12} \\ C_{21} & C_{22} \end{bmatrix}$$

$$A \cdot B = C$$

$$\begin{aligned} C_{11} &= A_{11} \cdot B_{11} + A_{12} \cdot B_{21} \\ C_{12} &= A_{11} \cdot B_{12} + A_{12} \cdot B_{22} \\ C_{21} &= A_{21} \cdot B_{11} + A_{22} \cdot B_{21} \\ C_{22} &= A_{21} \cdot B_{12} + A_{22} \cdot B_{22} \end{aligned}$$

$$\begin{aligned} \mathrm{I} &= (A_{11} + A_{22}) \cdot (B_{11} + B_{22}) \\ \mathrm{II} &= (A_{21} + A_{22}) \cdot B_{11} \\ \mathrm{III} &= A_{11} \cdot (B_{12} - B_{22}) \\ \mathrm{IV} &= A_{22} \cdot (-B_{11} + B_{21}) \\ \mathrm{V} &= (A_{11} + A_{12}) \cdot B_{22} \\ \mathrm{VI} &= (-A_{11} + A_{21}) \cdot (B_{11} + B_{12})) \\ \mathrm{VII} &= (A_{12} - A_{22}) \cdot (B_{21} + B_{22}) \end{aligned}$$

$$\begin{aligned} C_{11} &= \mathrm{I} + \mathrm{IV} - \mathrm{V} + \mathrm{VII} \\ C_{21} &= \mathrm{II} + \mathrm{IV} \\ C_{12} &= \mathrm{III} + \mathrm{V} \\ C_{22} &= \mathrm{I} + \mathrm{III} - \mathrm{II} + \mathrm{VI} \end{aligned}$$

$$\begin{aligned} C_{11} &= (A_{11} + A_{22}) \cdot (B_{11} + B_{22}) + A_{22} \cdot (-B_{11} + B_{21}) - (A_{11} + A_{12}) \cdot B_{22} + (A_{12} - A_{22}) \cdot (B_{21} + B_{22}) C_{21} \\ C_{11} &= A_{11}B_{11} + A_{11}B_{22} + A_{22}B_{11} + A_{22}B_{22} - A_{22}B_{11} + A_{22}B_{21} - A_{11}B_{22} - A_{12}B_{22} + A_{12}B_{21} + A_{12}B_{22} - A_{22}B_{21} - A_{22}B_{22} \\ C_{11} &= A_{11}B_{11} + A_{12}B_{21} \end{aligned}$$