So:

* $C_{ij} = \sum_{k=1}^{3} A_{ik} \cdot B_{kj}$

Rotation tensor:

* $S' = RSR^T \Rightarrow S'_{ij} = \sum_{1}^{k} \sum_{1}^{l} R_{ik} \cdot R_{jl} \cdot S_{kl}$
* $S = R^T S' R \Rightarrow S_{ij} = \sum_{1}^{m} \sum_{1}^{n} R_{mi} \cdot R_{nj} \cdot S'_{mn}$

$$\Rightarrow A_{ik} = R_{mi} R_{nk} \cdot A'_{mn}$$

$$B_{kj} = R_{pk} \cdot R_{qj} B'_{pq}$$

the proof

$$\Rightarrow C_{ij} = A_{ik} \cdot B_{kj} = (R_{mi} \cdot R_{nk} A'_{mn})(R_{pk} R_{qj} B'_{pq})$$

$$C_{ij} = R_{mi} R_{qj} A'_{mn} \cdot \underbrace{R_{nk} \cdot R_{pk} B'_{pq}}_{\text{need to be } B'_{kq}}$$

?

$$\Rightarrow C_{ij} = R_{mi} R_{qj} \overbrace{A'_{mn} \cdot B'_{kq}}^{C'_{mq}}$$

$$\Rightarrow \boxed{C_{ij} = R_{mi} R_{qj} C'_{mq}}$$

prove