

$$\frac{\partial^2 \mathcal{J}}{\partial \mathbf{s} \partial \mathbf{s}^T} = \mathbf{R} + \mathbf{Q} \underbrace{\frac{\partial^2 \mathcal{J}}{\partial \boldsymbol{\sigma} \partial \boldsymbol{\sigma}^T}}_{\rightarrow \mathcal{J}_\Sigma} \mathbf{Q}^T, \quad \text{with} \quad R_{ij} = \sum_{p=1}^N \frac{\partial^2 \boldsymbol{\sigma}_p}{\partial s_i \partial s_j^T} \frac{\partial \mathcal{J}}{\partial \boldsymbol{\sigma}_p}$$