

第一章-习题 3

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1 第一题

$$\begin{aligned}\frac{d(R^{-1}p)}{dR} &= \lim_{\phi \rightarrow 0} \frac{(R \exp(\phi^\wedge))^T p - R^T p}{\phi} \\&= \lim_{\phi \rightarrow 0} \frac{(\exp(\phi^\wedge))^T R^T p - R^T p}{\phi} \\&= \lim_{\phi \rightarrow 0} \frac{(I + \phi^\wedge)^T R^T p - R^T p}{\phi} \\&= \lim_{\phi \rightarrow 0} \frac{(\phi^\wedge)^T R^T p}{\phi} \\&= \lim_{\phi \rightarrow 0} \frac{(-\phi)^\wedge R^T p}{\phi} \\&= \lim_{\phi \rightarrow 0} \frac{R^T (-\phi)^\wedge p}{\phi} \\&= \lim_{\phi \rightarrow 0} \frac{R^T p^\wedge (-\phi)}{\phi} \\&= R^T p^\wedge\end{aligned}\tag{1}$$

2 第二题

$$\begin{aligned}
\frac{d \ln(R_1 R_2^{-1})}{d R_2} &= \lim_{\phi \rightarrow 0} \frac{\ln(R_1 R_2 \exp(\phi^\wedge)^T) - \ln(R_1 R_2^T)}{\phi} \\
&= \lim_{\phi \rightarrow 0} \frac{\ln(R_1 (\exp(\phi^\wedge))^T R_2^T) - \ln(R_1 R_2^T)}{\phi} \\
&= \lim_{\phi \rightarrow 0} \frac{\ln(R_1 R_2^T R_2 (\exp(\phi^\wedge))^T R_2^T) - \ln(R_1 R_2^T)}{\phi} \\
&= \lim_{\phi \rightarrow 0} \frac{\ln(R_1 R_2^T (R_2 \exp(\phi^\wedge) R_2^T)^T) - \ln(R_1 R_2^T)}{\phi} \\
&= \lim_{\phi \rightarrow 0} \frac{\ln(R_1 R_2^T (\exp((R_2 \phi)^\wedge))^T) - \ln(R_1 R_2^T)}{\phi} \quad (2) \\
&= \lim_{\phi \rightarrow 0} \frac{\ln(R_1 R_2^T \exp((-R_2 \phi)^\wedge)) - \ln(R_1 R_2^T)}{\phi} \\
&= \lim_{\phi \rightarrow 0} \frac{\ln(R_1 R^T) + J_r^{-1}(-R_2 \phi) - \ln(R_1 R_2^T)}{\phi} \\
&= \lim_{\phi \rightarrow 0} \frac{-J_r^{-1}(R_2 \phi)}{\phi} \\
&= -J_r^{-1}((\ln(R_1 R_2^{-1}))^\vee) R_2
\end{aligned}$$