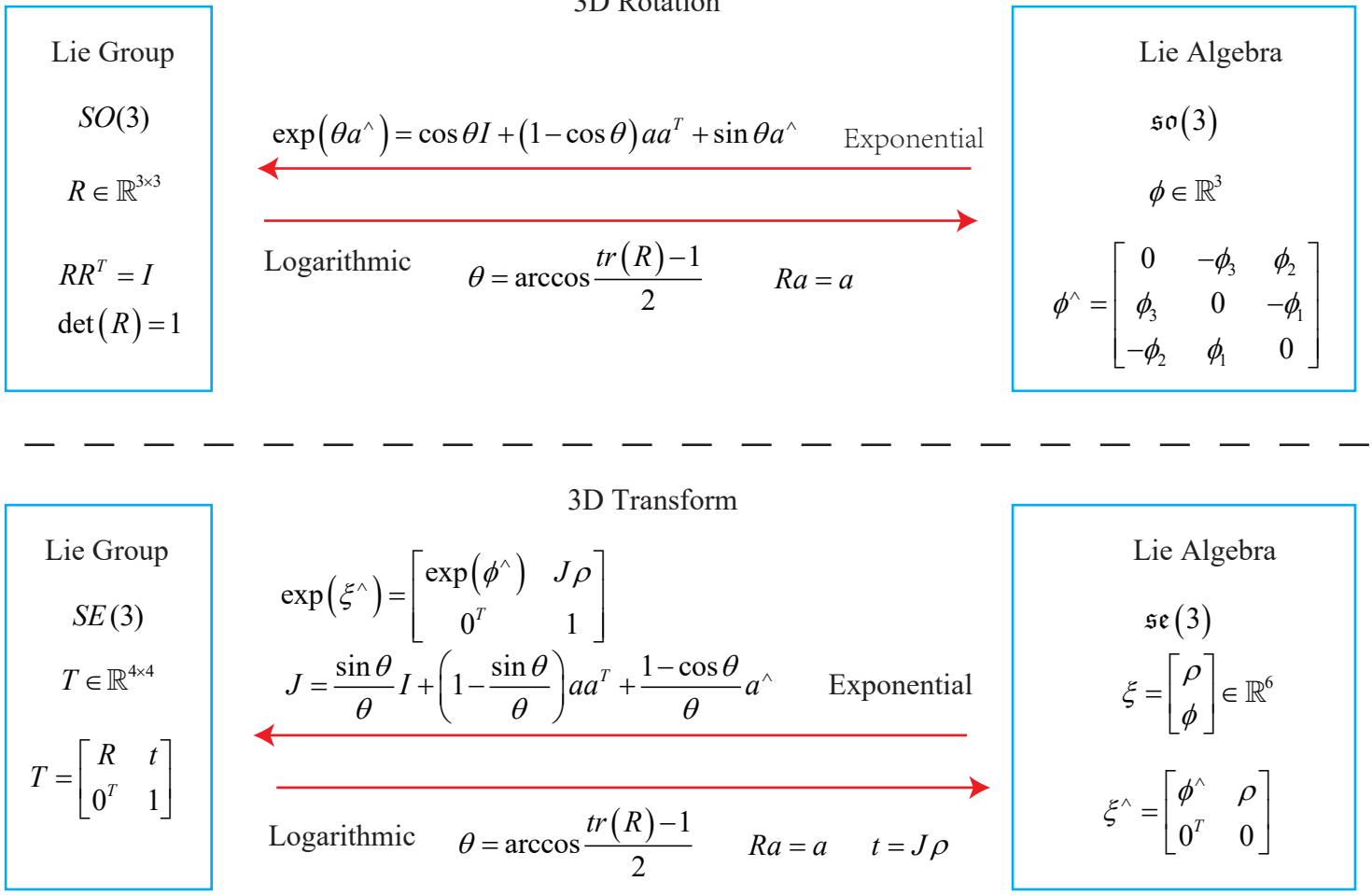
3D Rotation
Lie Group
$SO(3)$
$R \in \mathbb{R}^{3\times 3}$
$RR^T = I$
$\det(R) = 1$
$\exp(\theta a^\wedge) = \cos\theta I + (1-\cos\theta) aa^T + \sin\theta a^\wedge$
Exponential
Logarithmic
$\theta = \arccos \frac{tr(R)-1}{2}$
$Ra = a$
Lie Algebra
$\mathfrak{so}(3)$
$\phi \in \mathbb{R}^3$
$\phi^\wedge = \begin{bmatrix} 0 & -\phi_3 & \phi_2 \\ \phi_3 & 0 & -\phi_1 \\ -\phi_2 & \phi_1 & 0 \end{bmatrix}$
3D Transform
Lie Group
$SE(3)$
$T \in \mathbb{R}^{4\times 4}$
$T = \begin{bmatrix} R & t \\ 0^T & 1 \end{bmatrix}$
$\exp(\xi^\wedge) = \begin{bmatrix} \exp(\phi^\wedge) & J\rho \\ 0^T & 1 \end{bmatrix}$
$J = \frac{\sin\theta}{\theta} I + \left(1 - \frac{\sin\theta}{\theta}\right) aa^T + \frac{1-\cos\theta}{\theta} a^\wedge$
Exponential
Logarithmic
$\theta = \arccos \frac{tr(R)-1}{2}$
$Ra = a$
$t = J\rho$
Lie Algebra
$\mathfrak{se}(3)$
$\xi = \begin{bmatrix} \rho \\ \phi \end{bmatrix} \in \mathbb{R}^6$
$\xi^\wedge = \begin{bmatrix} \phi^\wedge & \rho \\ 0^T & 0 \end{bmatrix}$