					1	Tangent space		Exponential map		
					•	Lie algebra	Cartesian	,	•	
Lie group \mathcal{M}, \circ		size	dim	$\mathcal{X} \in \mathcal{M}$	Constraint	$oldsymbol{ au}^\wedge \in \mathfrak{m}$	$oldsymbol{ au} \in \mathbb{R}^m$	$\mathrm{Exp}\left(oldsymbol{ au} ight)$	Comp.	Action
n-D vector	$\mathbb{R}^n, +$	n	n	$\mathbf{v} \in \mathbb{R}^n$	$\mathbf{v} - \mathbf{v} = 0$	$\mathbf{v} \in \mathbb{R}^n$	$\mathbf{v} \in \mathbb{R}^n$	$\mathbf{v} = \exp\left(\mathbf{v}\right)$	${\bf v}_1 + {\bf v}_2$	$\mathbf{v} + \mathbf{x}$
circle	S^1, \cdot	2	1	$\mathbf{z} \in \mathbb{C}$	$\mathbf{z} * \mathbf{z} = 1$	$i\theta \in i\mathbb{R}$	$\theta \in \mathbb{R}$	$\mathbf{z} = \exp\left(i\theta\right)$	$\mathbf{z}_1 \mathbf{z}_2$	ZX
Rotation	$SO(2), \cdot$	4	1	R	$\mathbf{R}^{ op}\mathbf{R} = \mathbf{I}$	$[\theta]_{\times} \in \mathfrak{so}(2)$	$ heta \in \mathbb{R}$	$\mathbf{R} = \exp\left(\left[\theta\right]_{\times}\right)$	$\mathbf{R}_1 \mathbf{R}_2$	$\mathbf{R}\mathbf{x}$
Rigid motion	$SE(2), \cdot$	9	3	$\mathbf{M} = \left[\begin{array}{cc} \mathbf{R} & \mathbf{t} \\ 0 & 1 \end{array} \right]$	$\mathbf{R}^{ op}\mathbf{R} = \mathbf{I}$	$\left[\begin{array}{cc} [\theta]_{\times} & \boldsymbol{\rho} \\ 0 & 0 \end{array}\right] \in \mathfrak{se}(2)$	$\left[egin{array}{c} oldsymbol{ ho} \ heta \end{array} ight]\in\mathbb{R}^3$	$\exp\left(\left[\begin{array}{cc} [heta]_{ imes} & oldsymbol{ ho} \\ 0 & 0 \end{array} ight] ight)$	$\mathbf{M}_1\mathbf{M}_2$	$\mathbf{R} \mathbf{x} + \mathbf{t}$
3-sphere	S^3 , ·	4	3	$\mathbf{q} \in \mathbb{H}$	$\mathbf{q}^*\mathbf{q} = 1$	$\theta/2 \in \mathbb{H}_p$	$oldsymbol{ heta} \in \mathbb{R}^3$	$\mathbf{q} = \exp\left(\mathbf{u}\theta/2\right)$	$\mathbf{q}_1 \mathbf{q}_2$	$\mathbf{q} \mathbf{x} \mathbf{q}^*$
Rotation	$SO(3), \cdot$	9	3	R	$\mathbf{R}^{ op}\mathbf{R} = \mathbf{I}$	$[\boldsymbol{\theta}]_{\times} \in \mathfrak{so}(3)$	$oldsymbol{ heta} \in \mathbb{R}^3$	$\mathbf{R} = \exp\left(\left[oldsymbol{ heta} ight]_{ imes} ight)$	$\mathbf{R}_1 \mathbf{R}_2$	Rx
Rigid motion	$SE(3), \cdot$	16	6	$\mathbf{M} = \begin{bmatrix} \mathbf{R} & \mathbf{t} \\ 0 & 1 \end{bmatrix}$	$\mathbf{R}^{ op}\mathbf{R} = \mathbf{I}$	$\left[\begin{array}{cc} [\boldsymbol{\theta}]_{\times} & \boldsymbol{\rho} \\ 0 & 0 \end{array}\right] \in \mathfrak{se}(3)$	$\left[egin{array}{c} oldsymbol{ ho} \ oldsymbol{ heta} \end{array} ight]\in\mathbb{R}^6$	$\exp\left(\left[\begin{array}{cc} [m{ heta}]_{ imes} & m{ ho} \\ 0 & 0 \end{array}\right]\right)$	$\mathbf{M}_1\mathbf{M}_2$	$\mathbf{R}\mathbf{x} + \mathbf{t}$