

ASBR THA2 Test Results Report

Daniyal Maroufi and Anas Yousaf

Test Report for `rotmat2axisangle` Function

Test Case 1: 90-degree rotation around z-axis

- **Input:**

$$R_1 = \begin{bmatrix} 0 & -1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

- **Output:**

$$\text{axis}_1 = \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}, \quad \text{angle}_1 = \frac{\pi}{2}$$

- **Status:** Passed

Test Case 2: 60-degree rotation around x-axis

- **Input:**

$$R_2 = \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos\left(\frac{\pi}{3}\right) & -\sin\left(\frac{\pi}{3}\right) \\ 0 & \sin\left(\frac{\pi}{3}\right) & \cos\left(\frac{\pi}{3}\right) \end{bmatrix}$$

- **Output:**

$$\text{axis}_2 = \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}, \quad \text{angle}_2 = \frac{\pi}{3}$$

- **Status:** Passed

Test Case 3: Identity matrix

- **Input:**

$$R_3 = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

- **Output:**

$$\text{axis}_3 = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}, \quad \text{angle}_3 = 0$$

- **Status:** Passed

Test Case 4: 180-degree rotation around x-axis

- **Input:**

$$R_4 = \begin{bmatrix} -1 & 0 & 0 \\ 0 & -1 & 0 \\ 0 & 0 & -1 \end{bmatrix}$$

- **Output:**

$$\text{axis}_4 = \text{NaN}, \quad \text{angle}_4 = \pi$$

- **Status:** Passed

Test Case 5: Zero matrix

- **Input:**

$$R_5 = \begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$$

- **Output:**

$$\text{axis}_5 = \text{NaN}, \quad \text{angle}_5 = 0$$

- **Status:** Passed

Test Case 6: Invalid rotation matrix

- **Input:**

$$R_6 = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}$$

- **Output:**

$$\text{axis}_6 = \text{NaN}, \quad \text{angle}_6 = 0$$

- **Status:** Passed

Test Case 7: Large rotation angle

- **Input:**

$$R_7 = \begin{bmatrix} 0 & -1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

- **Output:**

$$\text{axis}_7 = \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}, \quad \text{angle}_7 = \frac{\pi}{2}$$

- **Status:** Passed

Test Case 8: Small rotation angle

- **Input:**

$$R_8 = \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos(1 \times 10^{-3}) & -\sin(1 \times 10^{-3}) \\ 0 & \sin(1 \times 10^{-3}) & \cos(1 \times 10^{-3}) \end{bmatrix}$$

- **Output:**

$$\text{axis}_8 = \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}, \quad \text{angle}_8 = 1 \times 10^{-3}$$

- **Status:** Passed

Test Case 9: Negative rotation angle

- **Input:**

$$R_9 = \begin{bmatrix} 0 & 1 & 0 \\ -1 & 0 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

- **Output:**

$$\text{axis}_9 = \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}, \quad \text{angle}_9 = -\frac{\pi}{2}$$

- **Status:** Passed

Test Case 10: Non-orthogonal matrix

Input:

$$R_{10} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 2 \end{bmatrix}$$

Output:

$$\text{axis}_{10} = \text{NaN}, \quad \text{angle}_{10} = 0$$

Status: Passed

Test Case 11: Matrix with NaN values

Input:

$$R_{11} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & \text{NaN} & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

Output:

$$\text{axis}_{11} = \text{NaN}, \quad \text{angle}_{11} = 0$$

Status: Passed

Test Case 12: Matrix with Inf values

Input:

$$R_{12} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & \infty & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

Output:

$$\text{axis}_{12} = \text{NaN}, \quad \text{angle}_{12} = 0$$

Status: Passed

Test Case 13: Matrix with values less than -1

Input:

$$R_{13} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & -2 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

Output:

$$\text{axis}_{13} = \text{NaN}, \quad \text{angle}_{13} = 0$$

Status: Passed

Test Report for rotmat2quaternion Function

Test Case 1: 90-degree rotation around z-axis

• **Input:**

$$R_1 = \begin{bmatrix} 0 & -1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

• **Output:**

$$q_1 = \begin{bmatrix} \frac{\sqrt{2}}{2} \\ 0 \\ 0 \\ \frac{\sqrt{2}}{2} \end{bmatrix}$$

• **Status:** Passed

Test Case 2: 60-degree rotation around x-axis

• **Input:**

$$R_2 = \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos\left(\frac{\pi}{3}\right) & -\sin\left(\frac{\pi}{3}\right) \\ 0 & \sin\left(\frac{\pi}{3}\right) & \cos\left(\frac{\pi}{3}\right) \end{bmatrix}$$

- **Output:**

$$q_2 = \begin{bmatrix} \cos\left(\frac{\pi}{6}\right) \\ \sin\left(\frac{\pi}{6}\right) \\ 0 \\ 0 \end{bmatrix}$$

- **Status:** Passed

Test Case 3: Identity matrix

- **Input:**

$$R_3 = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

- **Output:**

$$q_3 = \begin{bmatrix} 1 \\ 0 \\ 0 \\ 0 \end{bmatrix}$$

- **Status:** Passed

Test Case 4: 180-degree rotation around x-axis

- **Input:**

$$R_4 = \begin{bmatrix} 1 & 0 & 0 \\ 0 & -1 & 0 \\ 0 & 0 & -1 \end{bmatrix}$$

- **Output:**

$$q_4 = \begin{bmatrix} 0 \\ 1 \\ 0 \\ 0 \end{bmatrix}$$

- **Status:** Passed

Test Case 5: Zero matrix

- **Input:**

$$R_5 = \begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$$

- **Output:**

$$q_5 = \begin{bmatrix} \text{NaN} \\ \text{NaN} \\ \text{NaN} \\ \text{NaN} \end{bmatrix}$$

- **Status:** Passed

Test Case 6: Invalid rotation matrix

- **Input:**

$$R_6 = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}$$

- **Output:**

$$q_6 = \begin{bmatrix} \text{NaN} \\ \text{NaN} \\ \text{NaN} \\ \text{NaN} \end{bmatrix}$$

- **Status:** Passed

Test Case 7: Large rotation angle

- **Input:**

$$R_7 = \begin{bmatrix} 0 & -1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

- **Output:**

$$q_7 = \begin{bmatrix} \frac{\sqrt{2}}{2} \\ 0 \\ 0 \\ \frac{\sqrt{2}}{2} \end{bmatrix}$$

- **Status:** Passed

Test Case 8: Small rotation angle

- **Input:**

$$R_8 = \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos(1 \times 10^{-3}) & -\sin(1 \times 10^{-3}) \\ 0 & \sin(1 \times 10^{-3}) & \cos(1 \times 10^{-3}) \end{bmatrix}$$

- **Output:**

$$q_8 = \begin{bmatrix} \cos\left(\frac{1 \times 10^{-3}}{2}\right) \\ \sin\left(\frac{1 \times 10^{-3}}{2}\right) \\ 0 \\ 0 \end{bmatrix}$$

- **Status:** Passed

Test Case 9: Negative rotation angle around x-axis

- **Input:**

$$R_9 = \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos\left(-\frac{\pi}{3}\right) & -\sin\left(-\frac{\pi}{3}\right) \\ 0 & \sin\left(-\frac{\pi}{3}\right) & \cos\left(-\frac{\pi}{3}\right) \end{bmatrix}$$

- **Output:**

$$q_9 = \begin{bmatrix} \cos\left(-\frac{\pi}{6}\right) \\ \sin\left(-\frac{\pi}{6}\right) \\ 0 \\ 0 \end{bmatrix}$$

- **Status:** Passed

Test Case 10: Negative rotation angle around y-axis

- **Input:**

$$R_{10} = \begin{bmatrix} \cos\left(-\frac{\pi}{3}\right) & 0 & \sin\left(-\frac{\pi}{3}\right) \\ 0 & 1 & 0 \\ -\sin\left(-\frac{\pi}{3}\right) & 0 & \cos\left(-\frac{\pi}{3}\right) \end{bmatrix}$$

- **Output:**

$$q_{10} = \begin{bmatrix} \cos\left(-\frac{\pi}{6}\right) \\ 0 \\ \sin\left(-\frac{\pi}{6}\right) \\ 0 \end{bmatrix}$$

- **Status:** Passed

Test Case 11: Negative rotation angle around z-axis

- **Input:**

$$R_{11} = \begin{bmatrix} \cos\left(-\frac{\pi}{3}\right) & -\sin\left(-\frac{\pi}{3}\right) & 0 \\ \sin\left(-\frac{\pi}{3}\right) & \cos\left(-\frac{\pi}{3}\right) & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

- **Output:**

$$q_{11} = \begin{bmatrix} \cos\left(-\frac{\pi}{6}\right) \\ 0 \\ 0 \\ \sin\left(-\frac{\pi}{6}\right) \end{bmatrix}$$

- **Status:** Passed

Test Case 12: Matrix with NaN values

- **Input:**

$$R_{12} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & \text{NaN} & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

- **Output:**

$$q_{12} = \begin{bmatrix} \text{NaN} \\ \text{NaN} \\ \text{NaN} \\ \text{NaN} \end{bmatrix}$$

- **Status:** Passed

Test Case 13: Matrix with Inf values

- **Input:**

$$R_{13} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & \infty & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

- **Output:**

$$q_{13} = \begin{bmatrix} \text{NaN} \\ \text{NaN} \\ \text{NaN} \\ \text{NaN} \end{bmatrix}$$

- **Status:** Passed

Test Case 14: Matrix with values less than -1

- **Input:**

$$R_{14} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & -2 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

- **Output:**

$$q_{14} = \begin{bmatrix} \text{NaN} \\ \text{NaN} \\ \text{NaN} \\ \text{NaN} \end{bmatrix}$$

- **Status:** Passed

Test Report for rotmat2zyz Function

Test Case 1: 90-degree Rotation Around y-axis

- **Input:**

$$R_1 = \begin{bmatrix} 0 & 0 & 1 \\ 0 & 1 & 0 \\ -1 & 0 & 0 \end{bmatrix}$$

- **Output:**

$$(\phi_1, \theta_1, \psi_1) = (0, \frac{\pi}{2}, 0)$$

- **Status:** Passed

Test Case 2: Identity Matrix

- **Input:**

$$R_2 = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

- **Output:**

$$(\phi_2, \theta_2, \psi_2) = (\text{NaN}, \text{NaN}, \text{NaN})$$

- **Status:** Passed

Test Case 3: Zero Matrix

- **Input:**

$$R_3 = \begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$$

- **Output:**

$$(\phi_3, \theta_3, \psi_3) = (\text{NaN}, \text{NaN}, \text{NaN})$$

- **Status:** Passed

Test Case 4: Invalid Rotation Matrix

- **Input:**

$$R_4 = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}$$

- **Output:**

$$(\phi_4, \theta_4, \psi_4) = (\text{NaN}, \text{NaN}, \text{NaN})$$

- **Status:** Passed

Test Case 5: Small Rotation Angle Around y-axis

- **Input:**

$$R_5 = \begin{bmatrix} \cos(1 \times 10^{-3}) & 0 & \sin(1 \times 10^{-3}) \\ 0 & 1 & 0 \\ -\sin(1 \times 10^{-3}) & 0 & \cos(1 \times 10^{-3}) \end{bmatrix}$$

- **Output:**

$$(\phi_5, \theta_5, \psi_5) = (0, 1 \times 10^{-3}, 0)$$

- **Status:** Passed

Test Case 6: A Rotation Matrix with a Set of Angles

- **Input:**

$$R_6 = \text{eul2rotm}((\frac{\pi}{3}, \frac{\pi}{6}, -\frac{\pi}{3}), ZYZ) = \begin{bmatrix} 0.9665 & -0.0580 & 0.2500 \\ -0.0580 & 0.8995 & 0.4330 \\ -0.2500 & -0.4330 & 0.8660 \end{bmatrix}$$

- **Output:**

$$(\phi_6, \theta_6, \psi_6) = \text{rotm2eul}(R_6, ZYZ) = (-2.0944, -0.5236, 2.0944)$$

- **Status:** Passed

Test Case 7: Singular Case: $\theta = \pi/2$

- **Input:**

$$R_7 = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 0 & -1 \\ 0 & 1 & 0 \end{bmatrix}$$

- **Output:**

$$(\phi_7, \theta_7, \psi_7) = (0, \frac{\pi}{2}, 0)$$

- **Status:** Passed

Test Case 8: Rotation Around z-axis with $\theta = 0$

- **Input:**

$$R_8 = \begin{bmatrix} 0 & -1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

- **Output:**

$$(\phi_8, \theta_8, \psi_8) = (0, 0, \frac{\pi}{2})$$

- **Status:** Passed

Test Case 9: Rotation Around z-axis with $\theta = \pi$

- **Input:**

$$R_9 = \begin{bmatrix} 0 & -1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & -1 \end{bmatrix}$$

- **Output:**

$$(\phi_9, \theta_9, \psi_9) = (0, \pi, \frac{\pi}{2})$$

- **Status:** Passed

Test Report for rotmat2rollpitchyaw Function

Test Case 1: 90-degree rotation around y-axis

Input:

$$R_1 = \begin{bmatrix} 0 & 0 & 1 \\ 0 & 1 & 0 \\ -1 & 0 & 0 \end{bmatrix}$$

Output:

$$\phi_1 = 0, \quad \theta_1 = \frac{\pi}{2}, \quad \psi_1 = 0$$

Status: Passed

Test Case 2: Identity matrix

Input:

$$R_2 = I_3$$

Output:

$$\phi_2 = \text{NaN}, \quad \theta_2 = \text{NaN}, \quad \psi_2 = \text{NaN}$$

Status: Passed

Test Case 3: Zero matrix

Input:

$$R_3 = \begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$$

Output:

$$\phi_3 = \text{NaN}, \quad \theta_3 = \text{NaN}, \quad \psi_3 = \text{NaN}$$

Status: Passed

Test Case 4: Invalid rotation matrix

Input:

$$R_4 = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}$$

Output:

$$\phi_4 = \text{NaN}, \quad \theta_4 = \text{NaN}, \quad \psi_4 = \text{NaN}$$

Status: Passed

Test Case 5: Small rotation angle around y-axis

Input:

$$R_5 = \begin{bmatrix} \cos(10^{-3}) & 0 & \sin(10^{-3}) \\ 0 & 1 & 0 \\ -\sin(10^{-3}) & 0 & \cos(10^{-3}) \end{bmatrix}$$

Output:

$$\phi_5 = 0, \quad \theta_5 = 10^{-3}, \quad \psi_5 = 0$$

Status: Passed

Test Case 6: 90-degree rotation around x-axis

Input:

$$R_6 = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 0 & -1 \\ 0 & 1 & 0 \end{bmatrix}$$

Output:

$$\phi_6 = 0, \quad \theta_6 = 0, \quad \psi_6 = \frac{\pi}{2}$$

Status: Passed

Test Case 7: Singular case: 90-degree rotation around y-axis

Input:

$$R_7 = \begin{bmatrix} 0 & 0 & 1 \\ 0 & 1 & 0 \\ -1 & 0 & 0 \end{bmatrix}$$

Output:

$$\phi_7 = 0, \quad \theta_7 = \frac{\pi}{2}, \quad \psi_7 = 0$$

Status: Passed

Test Case 8: 60-degree rotation around x-axis

Input:

$$R_8 = \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos\left(\frac{\pi}{3}\right) & -\sin\left(\frac{\pi}{3}\right) \\ 0 & \sin\left(\frac{\pi}{3}\right) & \cos\left(\frac{\pi}{3}\right) \end{bmatrix}$$

Output:

$$\phi_8 = 0, \quad \theta_8 = 0, \quad \psi_8 = \frac{\pi}{3}$$

Status: Passed

Test Case 9: 180-degree rotation around z-axis

Input:

$$R_9 = \begin{bmatrix} -1 & 0 & 0 \\ 0 & -1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

Output:

$$\phi_9 = \pi, \quad \theta_9 = 0, \quad \psi_9 = 0$$

Status: Passed

Test Report for axisangle2rotmat Function

Test Case 1: 90-degree rotation around z-axis

Input: - Axis: $[0; 0; 1]$ - Angle: $\frac{\pi}{2}$

Output:

$$R_1 = \begin{bmatrix} 0 & -1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

Status: Passed

Test Case 2: 60-degree rotation around x-axis

Input: - Axis: $[1; 0; 0]$ - Angle: $\frac{\pi}{3}$

Output:

$$R_2 = \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos(\frac{\pi}{3}) & -\sin(\frac{\pi}{3}) \\ 0 & \sin(\frac{\pi}{3}) & \cos(\frac{\pi}{3}) \end{bmatrix}$$

Status: Passed

Test Case 3: Identity matrix

Input: - Axis: $[1; 0; 0]$ - Angle: 0

Output:

$$R_3 = I_3$$

Status: Passed

Test Case 4: 180-degree rotation around x-axis

Input: - Axis: $[1; 0; 0]$ - Angle: π

Output:

$$R_4 = \begin{bmatrix} 1 & 0 & 0 \\ 0 & -1 & 0 \\ 0 & 0 & -1 \end{bmatrix}$$

Status: Passed

Test Case 5: Zero axis and zero angle

Input: - Axis: $[0; 0; 0]$ - Angle: 0

Output:

$$R_5 = I_3$$

Status: Passed

Test Case 6: Invalid axis

Input: - Axis: $[1; 3; 4]$ - Angle: $\frac{\pi}{2}$

Output:

$$R_6 = \text{NaN}(3)$$

Status: Passed

Test Case 7: Large rotation angle

Input: - Axis: $[0; 0; 1]$ - Angle: $\frac{\pi}{2}$

Output:

$$R_7 = \begin{bmatrix} 0 & -1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

Status: Passed

Test Case 8: Small rotation angle

Input: - Axis: $[1; 0; 0]$ - Angle: 1×10^{-3}

Output:

$$R_8 = \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos(1 \times 10^{-3}) & -\sin(1 \times 10^{-3}) \\ 0 & \sin(1 \times 10^{-3}) & \cos(1 \times 10^{-3}) \end{bmatrix}$$

Status: Passed

Test Case 9: Negative rotation angle

Input: - Axis: $[0; 0; 1]$ - Angle: $\frac{3\pi}{2}$

Output:

$$R_9 = \begin{bmatrix} 0 & 1 & 0 \\ -1 & 0 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

Status: Passed

Test Case 10: Negative rotation axis

Input: - Axis: $[0; 0; -1]$ - Angle: $\frac{\pi}{2}$

Output:

$$R_{10} = \begin{bmatrix} 0 & 1 & 0 \\ -1 & 0 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

Status: Passed

Test Case 11: Axis with NaN values

Input: - Axis: $[\text{NaN}; 1; 0]$ - Angle: π

Output:

$$R_{11} = \text{NaN}(3)$$

Status: Passed

Test Case 12: Axis with Inf values

Input: - Axis: $[\text{Inf}; 1; 0]$ - Angle: π

Output:

$$R_{12} = \text{NaN}(3)$$

Status: Passed

Test Case 13: Axis with values less than -1

Input: - Axis: $[1; -2; 0]$ - Angle: $\frac{\pi}{2}$

Output:

$$R_{13} = \text{NaN}(3)$$

Status: Passed

Summary: All tests passed.

Test Report for quaternion2rotmat Function

Test Case 1: 90-degree rotation around z-axis

- **Input:**

$$q_1 = \left[\frac{\sqrt{2}}{2}, 0, 0, \frac{\sqrt{2}}{2} \right]$$

- **Expected Output:**

$$R_1 = \begin{bmatrix} 0 & -1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

- **Status:** Passed

Test Case 2: 60-degree rotation around x-axis

- **Input:**

$$q_2 = \left[\cos\left(\frac{\pi}{6}\right), \sin\left(\frac{\pi}{6}\right), 0, 0 \right]$$

- **Expected Output:**

$$R_2 = \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos\left(\frac{\pi}{3}\right) & -\sin\left(\frac{\pi}{3}\right) \\ 0 & \sin\left(\frac{\pi}{3}\right) & \cos\left(\frac{\pi}{3}\right) \end{bmatrix}$$

- **Status:** Passed

Test Case 3: Identity matrix

- **Input:**

$$q_3 = [1, 0, 0, 0]$$

- **Expected Output:**

$$R_3 = I_3$$

- **Status:** Passed

Test Case 4: 180-degree rotation around x-axis

- **Input:**

$$q_4 = [0, 1, 0, 0]$$

- **Expected Output:**

$$R_4 = \begin{bmatrix} 1 & 0 & 0 \\ 0 & -1 & 0 \\ 0 & 0 & -1 \end{bmatrix}$$

- **Status:** Passed

Test Case 5: Zero quaternion

- **Input:**

$$q_5 = [0, 0, 0, 0]$$

- **Expected Output:**

$$R_5 = \text{NaN}(3)$$

- **Status:** Passed

Test Case 6: Invalid quaternion

- **Input:**

$$q_6 = [1, 2, 3, 4]$$

- **Expected Output:**

$$R_6 = \text{NaN}(3)$$

- **Status:** Passed

Test Case 7: Large rotation angle

- **Input:**

$$q_7 = \left[\frac{\sqrt{2}}{2}, 0, 0, \frac{\sqrt{2}}{2} \right]$$

- **Expected Output:**

$$R_7 = \begin{bmatrix} 0 & -1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

- **Status:** Passed

Test Case 8: Small rotation angle

- **Input:**

$$q_8 = \left[\cos\left(\frac{1 \times 10^{-3}}{2}\right), \sin\left(\frac{1 \times 10^{-3}}{2}\right), 0, 0 \right]$$

- **Expected Output:**

$$R_8 = \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos(1 \times 10^{-3}) & -\sin(1 \times 10^{-3}) \\ 0 & \sin(1 \times 10^{-3}) & \cos(1 \times 10^{-3}) \end{bmatrix}$$

- **Status:** Passed

Test Case 9: Negative rotation angle around x-axis

- **Input:**

$$q_9 = \left[\cos\left(\frac{\pi}{6}\right), \sin\left(-\frac{\pi}{6}\right), 0, 0 \right]$$

- **Expected Output:**

$$R_9 = \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos\left(-\frac{\pi}{3}\right) & -\sin\left(-\frac{\pi}{3}\right) \\ 0 & \sin\left(-\frac{\pi}{3}\right) & \cos\left(-\frac{\pi}{3}\right) \end{bmatrix}$$

- **Status:** Passed

Test Case 10: 180-degree rotation around z-axis

- **Input:**

$$q_{10} = [0, 0, 0, 1]$$

- **Expected Output:**

$$R_{10} = \begin{bmatrix} -1 & 0 & 0 \\ 0 & -1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

- **Status:** Passed

Test Case 11: Non-unit Quaternion

- **Input:**

$$q_{11} = [1, 2, 5, 7]$$

- **Expected Output:**

$$R_{11} = \text{NaN}(3)$$

- **Status:** Passed

Test Case 12: Quaternion with NaN values

- **Input:**

$$q_{12} = [1, \text{NaN}, 0, 1]$$

- **Expected Output:**

$$R_{12} = \text{NaN}(3)$$

- **Status:** Passed

Test Case 13: Quaternion with Inf values

- **Input:**

$$q_{13} = [1, \text{Inf}, 1, 0]$$

- **Expected Output:**

$$R_{13} = \text{NaN}(3)$$

- **Status:** Passed

Test Case 14: Quaternion with values less than -1

- **Input:**

$$q_{14} = [1, -2, 1, 0]$$

- **Expected Output:**

$$R_{14} = \text{NaN}(3)$$

- **Status:** Passed

Summary: All test cases passed.

Test Report for `test_inputTransfmatScrew`

Test Case 1: Screw Axis Transformation Based on Inputs

Title: Screw Axis Transformation Based on Inputs

Input: - $T_{\text{initial}} = \begin{bmatrix} 1 & 0 & 0 & 2 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$ - $p = [0 \ 2 \ 0]$ - $\hat{s} = [0 \ 0 \ 1]$ - $h = 2$ -

$$\theta = \pi$$

Output: - T_{final} : Transformation matrix after applying the screw transformation. - $T_{\text{intermediate}}$: Intermediate transformation matrix. - $point$: Point after transformation. - s_{axis} : Screw axis. - $pitch$: Pitch of the screw. - $angle$: Angle of rotation.

Status: Passed

Test Case 2: Screw Axis Transformation Back to Origin

Title: Screw Axis Transformation Back to Origin

Input: - T_{final} : Transformation matrix after applying the screw transformation. - $point$: Point after transformation. - s_{axis} : Screw axis. - $pitch$: Pitch of the screw. - $angle$: Angle of rotation.

Output: - T_{origin} : Transformation matrix back to the origin. - Other outputs are not used in this test case.

Status: Passed