UNIVERSITY of HOUSTON | ECE

ECE 5397/6397: Introduction to Robotics, Spring 2016

HW #1 Due Feb. 2

Discrete Grading Policy. 5 points for each: 2 points for trying, 3 points if partial answer, 5 point if correct.

4. Given a rotation matrix $R \in SO(3)$

$$R = \begin{bmatrix} 0.9220 & -0.1546 & 0.3551 \\ 0.3807 & 0.5303 & -0.7575 \\ -0.0712 & 0.8336 & 0.5477 \end{bmatrix}$$

Let V be a set of vectors, and $V \subset \mathbb{R}^3$, $V = \left\{ v \in V \mid \frac{Rv \cdot v}{\|v\|^2} = \frac{1}{2} \right\}$. You may use MATLAB, etc.

1) Use two-argument arctangent function to specify the Euler angles (ϕ, θ, φ) of the rotation transformation R
2) Give a physical interpretation of the set V. (There are three interpretations of a rotation matrix on Page 47. Try to find the right one to explain this set V)

As we have seen, rotation matrices can serve several roles. A rotation matrix, either $R \in SO(3)$ or $R \in SO(2)$, can be interpreted in three distinct ways:

1. It represents a coordinate transformation relating the coordinates of a point p in two different frames.
2. It gives the orientation of a transformed coordinate frame with respect to a fixed coordinate frame.
3. It is an operator taking a vector and rotating it to give a new vector in the same coordinate frame.