

Introduction to Flight Simulation (List 9)

Due: 14 december 2010

1. Write a function that multiplies quaternions.
2. Write a function that computes the norm $|q|$ of a quaternion.
3. Verify for a couple of quaternions, that

$$\frac{q\bar{q}}{|q|^2} = 1.$$

4. Implement the function $F_q(x) = q.x.q^{-1}$. Verify for a couple of different quaternions of form $x = (0, \bar{v})$ that the real component of $F_q(x) = 0$.
5. We are going to verify (by examples) that $F_q(x)$ represents a rotation. Try out that, for quaternions x with empty real components, that
 - (a) $|F_q(x)| = |x|$.
 - (b) $F_q(x_1) \times F_q(x_2) = F(x_1 \times x_2)$. The \times -operator means crossproduct, because x_1, x_2 have their real components 0. The real component of q does not have to be 0.
 - (c) By trying, find the axis of the rotation, i.e. vectors x , for which $F_q(x) = x$.
 - (d) The angle of rotation can be found by taking a unit \bar{u} vector parallel to the axis, and using

$$\cos(\phi) = \bar{e}.F_q(\bar{e}).$$

Try to determine the angle ϕ for given q .