# 1 Quaternion: a 4D complex numbers

The general form of a Quaternion number is:

$$q = aw + (bi + cj + dk)$$

which could be rewrite as a format of angle:

$$q = cos(\frac{\theta}{2}) + sin(\frac{\theta}{2})(u_b i + u_c j + u_d k)$$

where, $[u_b, u_c, u_D]^T$ is a vector of rotation axis.

# 2 Hamilton Product

To compute resultant point($p'$) of certain coordinate($p$), given the Quaternion number($q$) use Hamilton Product:

$$p' = qpq'$$

where, $q'$ is conjugate number of $q$, which is, for example:

$$q' = aw - (bi + cj + dk)$$