

To calculate the mean relative displacement and maximum relative displacement from a matrix of motion parameters you can do the following:

Motion parameters, translation: $\overrightarrow{R(t)}$

Motion parameters, rotation: $\overrightarrow{\theta(t)}$

Number of time points: $N+1$

Assumed lever arm: L

1. Calculate the 1st derivative

$$\Delta \overrightarrow{R(t)} = \frac{d\overrightarrow{R(t)}}{dt}$$

2. Calculate the instantaneous displacement

$$D(t) = \sqrt{|\Delta \overrightarrow{R(t)}|}$$

3. Calculate mean displacement over time (N=number of time points)

$$\bar{D} = \frac{\sum_t D(t)}{N}$$

4. Calculate the maximum displacement

$$D_{max} = \max (D(t))$$

To calculate the parameters for the rotation do all of the above, and then do again where after calculating $\Delta \overrightarrow{\theta(t)}$, calculate an effective displacement with

$$\Delta \overrightarrow{R(t)} = L \sin \Delta \overrightarrow{\theta(t)},$$

and then carry the calculation forward from step 2 on.