Subject: Re: Averaging quaternions
Posted by Arnold Neumaier on Fri, 19 Mar 2004 16:24:26 GMT
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John Lansberry wrote:
> "Craig Markwardt" <craigmnet@REMOVEcow.physics.wisc.edu> wrote in message
> news:on65d167y8.fsf@cow.physics.wisc.edu...
>
>> GrahamWilsonCA@yahoo.ca (Graham) writes:

>>> Does anyone know if it is possible to take an average of regularly
>>> sampled quaternions to get a mean orientation (i.e. a mean rotation
>>> matrix)? I seem to recall there being a trick involved but beyond
>>> re-normalizing the resuling (averaged) quaternion, I cannot remember
>>> what it is.
>
>> quaternions are degenerate. For each unique rotation, there are two
>> possible quaternions whose components have opposite signs. This is
>> because a positive rotation about axis V is identical to a negative
>> rotation about axis -V.
>>
>> If your system is capable of both signs indiscriminately, then you
>> must make the sign conventions uniform. For example, by always making
>> one component positive.

This will not work if the component is zero.
Averaging (0,q) and (0,-q) which are the same rotation gives 0,
which is meaningless.

Thus the average and scale procedure makes only sense if all quaternions
are oriented the same way. One way to achieve this for any set of
unit quaternions that do not stray too much is the following:

1. apply to all quaternions a rotation that moves one of them to 1
   (for example one that is closest to the trivial average),
2. orient all results to positive real part,
3. average the results,
4. rotate back the result,
5. normalize.

More costly but completely reliable.

Arnold Neumaier