Re: Planar Linkage Problem

Source: http://sci.tech−archive.net/Archive/sci.math/2004−10/1251.html

---

From: Ken Honda (*Honda_Kiai_at_hotmail.com*)
Date: 10/04/04

```
Date: 4 Oct 2004 11:18:59 −0700
```

So sorry, I should have phrased that more clearly. The diagram I gave was wrong, the assembly in question has four bars:

0 −−−− 1 −−−− 2 −−−− 3 −−−− P

and the angles at points 0,1,2, and 3 are all chosen randomly with a uniform distribution on [0,2pi)

> Or, did you mean that integration will give you a procedure where you
> need not bother about which of the two/several roots is to be taken?
> There is also a vector/complex variable method to do this...

What I meant was, my understanding of the manifold that arises from the configuration space of a planar linkage is that every point on that manifold maps to a unique configuration of the linkage. Therefore, if we can find a function that sends a point on this manifold to the distance from 0 to P, then find the "average value" of this function on the manifold, we'll be done. However, the post by R. Israel suggests to me that such an approach is unnecessary but that a closed−form solution is probably not available. May I ask how you chose the "th" and "gm" terminology?

Another thought I had on this problem: if you have only one rod:

0 −−−− 1

then of course the distance between endpoints is just 1. You can represent the probability distribution of endpoint distances as a delta function along the interval [0,1] (basically all the mass is concentrated at x=1, because there's zero probability that distance between endpoints is anything else).

Now, if you have two rods:

0 −−−− 1 −−−− 2

then you can see plainly that the distance between endpoints is 1 − cos(a_1). We want to get a probability distribution on the interval

[0,2] representing the likelihood of landing on a particular distance between endpoints. What happens when you convolve the probability distribution for the n=1 case with the extra vertex? For instance convolution of −cos(a_1) with the delta function gives you 1 − cos(a_1). Maybe one can get a solution by convolution with the most recent angle with the preceding distribution? My probability theory is weak, and I suspect that a closed−form solution here is still not feasible...
Thanks!
KH