Subject: plot dirac delta function?
Posted by Nic on Wed, 19 Jul 2006 10:30:04 GMT
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Hi all!

I am new to IDL and learning how to do non analytic plots such as a dirac delta function or a finite square well. Does anybody have ideas of what tools I should use or keywords to get started in plotting these?

thank you

Subject: Re: plot dirac delta function?
Posted by James Kuyper on Mon, 24 Jul 2006 02:07:52 GMT
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swingnut@gmail.com wrote:
> FYI, while the definition can be approached a number of equivalent
> ways, the value of the Dirac IS "well-defined" at delta(x).
> Technically, it's "well-defined" at the value such that its argument is
> zero (which here is x=0).
>
> The value is indeed infinity. At least, that's how it's used in
> physics.

No, it is not. I'm very well versed in the use of the dirac delta function in physics, and the value of delta(0) is never used in any meaningful sense. Any equation which attempts to make use of the value at zero is meaningless. The dirac delta function only becomes meaningful after you've integrated over it.

Subject: Re: plot dirac delta function?
Posted by swingnut on Sun, 30 Jul 2006 05:17:40 GMT
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Ah, I see we're about to head off into the realm of defining functions, ever a popular discussion (not the least of which is because I relish the opportunity to learn more about it, not being a mathematician). Why do you say this? In plasma kinetic theory a while back, the prof give us the pop quiz about the value of particle distributions made from sums of delta functions. As with the "How do you put an elephant into the refrigerator?" test, everyone jumped to the wrong answer since the integral of the Dirac delta is 1. The function wasn't a sum of integrals, its a sum of deltas, so the value of the distribution at a particle's parameters in the phase space we were working in is infinity.

Looking at a Dirac delta as the limit of a sequence of Guassians as the width of the guassian goes to zero with the constraint that the integral of the Dirac goes to one also provides the value of infinity, because that's the only way an integral could possibly be non-zero when its upper and lower bounds are the same.

Subject: Re: plot dirac delta function?
Posted by swingnut on Sun, 30 Jul 2006 05:27:28 GMT
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kuyper@wizard.net wrote:
> swingnut@gmail.com wrote:
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>> ways, the value of the Dirac IS "well-defined" at delta(x).
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> meaningful sense. Any equation which attempts to make use of the value
> at zero is meaningless. The dirac delta function only becomes
> meaningful after you've integrated over it.

FYI: the physical meaning of delta is used ALL the damn time when you're talking about the spatial distribution of point particles (think electrons and other extensionless subatomic particles here). If the particle has no extension, as is generally believed to be true for, e.g. electrons due to quantum considerations (classical radius of the electron and arguments like that), then the only way to describe a mass distribution is by summing up a bunch of things that are zero except for at a single point in "configuration space" with no physical extension. Following the logic, in any phase space, when the object's parameters are point values in that space, you get the same behavior for those parameters: a Dirac for the object's state. To say that delta(x-a) just means that the particle is at x=a in that phase space; x=0 refers to the origin of the phase space. These things are used all the time or underly other calculations that are used all the time. If you are using statistical mechanics at all, you should be seeing this regularly.

Another physical application is as the Green's function corresponding

to Guass's law for a point charge, the mathematics of which gets
quickly generalized for minimum variance packet in quantum mech. The
fun just never stops.

Subject: Re: plot dirac delta function?
Posted by James Kuyper on Sun, 30 Jul 2006 14:18:20 GMT
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swingnut@gmail.com wrote:
> Ah, I see we're about to head off into the realm of defining functions,
> ever a popular discussion (not the least of which is because I relish
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> us the pop quiz about the value of particle distributions made from
> sums of delta functions. As with the "How do you put an elephant into
> the refrigerator?" test, everyone jumped to the wrong answer since the
> integral of the Dirac delta is 1. The function wasn't a sum of
> integrals, its a sum of deltas, so the value of the distribution at a
> particle's parameters in the phase space we were working in is
> infinity.

That's just a test question about a intrinsically meaningless
intermediate step in a calculation. The only thing you can ever
meaningfully do with such a particle distribution function is integrate
over it, one way or another. The value of such a function at a given
point is meaningless, except in those places where it's zero, in which
case it's meaningful only as a simplified approximation to reality.
It's value at any point where it's non-zero is not a measurable
quantity. Can you show me any actual calculations where the value of a
dirac delta function at 0 is actually used to calculate something
meaningful, without being integrated over?

Subject: Re: plot dirac delta function?
Posted by James Kuyper on Sun, 30 Jul 2006 14:32:36 GMT
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swingnut@gmail.com wrote:
> kuyper@wizard.net wrote:
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>> function in physics, and the value of delta(0) is never used in any
>> meaningful sense. Any equation which attempts to make use of the value
>> at zero is meaningless. The dirac delta function only becomes
>> meaningful after you've integrated over it.
>

> FYI: the physical meaning of delta is used ALL the damn time when

I was not referring to the physical meaning of delta, which is that it represents a point source. I was referring specifically to the actual value of the Dirac delta function at 0; any equation that involves evaluating that function at that point, rather than integrating over it, to calculate a physically meaningful quantity is an error.

> you're talking about the spatial distribution of point particles (think
> electrons and other extensionless subatomic particles here). If the
> particle has no extension, as is generally believed to be true for,

Yes, it's considered quite likely that quarks and leptons are true point particles, which means that their physical extent is accurately described by a dirac delta function. However, any physically meaningful quantity you can calculate is not directly related to the value of that function at its center, but is instead calcuated directly or indirectlly from an integral over that function.

> e.g. electrons due to quantum considerations (classical radius of the
> electron and arguments like that), then the only way to describe a mass
> distribution is by summing up a bunch of things that are zero except
> for at a single point in "configuration space" with no physical
> extension. Following the logic, in any phase space, when the object's
> parameters are point values in that space, you get the same behavior
> for those parameters: a Dirac for the object's state. To say that
> delta(x-a) just means that the particle is at x=a in that phase space;
> x=0 refers to the origin of the phase space. These things are used all
> the time or underly other calculations that are used all the time. If
> you are using statistical mechanics at all, you should be seeing this
> regularly.

I haven't done any statistical mechanics in more than a decde, but when I was studying it, we used dirac delta functions all over the place. It's a very useful concept, and I've never denied that fact. But we never used the value of that fucntion at zero for any meaningful purpose. It only became meaningful after integration.

> Another physical application is as the Green's function corresponding
> to Guass's law for a point charge, the mathematics of which gets
> quickly generalized for minimum variance packet in quantum mech. The
> fun just never stops.

Again, that's an example where a Dirac delta function is a very useful tool - but only inside an integral, which is how Green's functions are always used. It's meaningless without the integral.

Subject: Re: plot dirac delta function?
Posted by Carsten Lechte on Fri, 11 Aug 2006 21:18:25 GMT
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I agree with what you said. The Dirac "function" is is
only defined by what it does under an integration. It is
really a distribution (generalised function), since no
normal function exists that behaves like the Dirac delta.

See http://en.wikipedia.org/wiki/Distribution_%28mathematics%29
for some details on distributions.

chl

Subject: Re: plot dirac delta function?
Posted by James Kuyper on Fri, 11 Aug 2006 22:35:05 GMT
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Carsten Lechte wrote:
> I agree with what you said. The Dirac "function" is is
> only defined by what it does under an integration. It is
> really a distribution (generalised function), since no
> normal function exists that behaves like the Dirac delta.
>
> See http://en.wikipedia.org/wiki/Distribution_%28mathematics%29
> for some details on distributions.

Thanks. I knew that mathematicians had tamed the DIrac Delta into
something they could actually make sense of, but I couldn't remember
the name they gave to the concept; it's probably been more than a
decade since I last needed to use that name.

Subject: Re: plot dirac delta function?
Posted by priorbee on Fri, 25 Nov 2016 10:13:21 GMT
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```
;dirac delata function
x = fltarr(100) ; creating 1D array of 100 zeroes
x(50.0) = 1.0 ; setting one point from array to not equal zero

plot, x ; plotting function
```