Subject: Re: Transforming a nonlinear equation
Posted by Paolo Grigis on Tue, 07 Aug 2007 16:12:30 GMT
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wlandsman wrote:
> The following task probably can't be done with IDL, but maybe some IDL
> users can point me in the right direction.
>
> I have a nonlinear equation in x, e.g.
>
> (1) y = 3.2 + 1.2*x + 3.1*x^2 - 4.2*x^3
>
> and I have a linear transformation in x: x' = 1.2*x + 0.4
> so I want to find the new coefficients of equation (1) under the
> transformation. If I were to do this with pencil and paper, I
> would put the transformation equation into (1), and collect all the
> cubic terms, quadratic terms etc. to find the new coefficients.
>
> I presume (but am not certain) that this is something that is very
> simple to do with Mathematica or Maple. But right now I only
> need it for a couple of equations so I'd prefer not to have to learn
> Mathematica (or do it by hand). Thanks, --Wayne
>

This should be feasible using the binomial expansion formula

(a+b)^n =sum_i^n binomial(i,n) * a^i * b^(n-i)

If the original polynomial is given by an array a with the coefficients
index equal its order, and x=alpha*y+beta is the linear transformation,
then the following code should deliver the new coefficients of the
y-polynomial:

```
degree=n_elements(a)-1

newarray=a*0

FOR i=0,degree DO BEGIN
   FOR j=0,i DO BEGIN
      newarray[j]=newarray[j]+a[i]*binomial(j,i)*alpha^j*beta^(i-j )
   ENDFOR
ENDFOR
```

where the binomial(j,n) function returns
factorial(n)/(factorial(j)*factorial(n-j))

Ciao,
Paolo

Subject: Re: Transforming a nonlinear equation
Posted by wlandsman on Tue, 07 Aug 2007 17:37:32 GMT
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Very nice. Thanks.

I now realize that I actually have a nonlinear function of two variables f(x,y) and need to find the new coefficients under linear transformations of x-->x' and y-->y'. So I'll need to first find the new X coefficients for each term in Y, and then find the new Y coefficients for each term in X'. But it should be straightforward, if tedious. --Wayne

> then the following code should deliver the new coefficients of the
> y-polynomial:
>
> degree=n_elements(a)-1
>
> newarray=a*0
>
> FOR i=0,degree DO BEGIN
> FOR j=0,i DO BEGIN
> newarray[j]=newarray[j]+a[i]*binomial(j,i)*alpha^j*beta^(i-j)
> ENDFOR
> ENDFOR
>
> where the binomial(j,n) function returns
> factorial(n)/(factorial(j)*factorial(n-j))
>
> Ciao,
> Paolo

Subject: Re: Transforming a nonlinear equation
Posted by Marshall Perrin on Fri, 10 Aug 2007 05:53:56 GMT
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Hi Wayne,

wlandsman <wlandsman@gmail.com> wrote:
> I presume (but am not certain) that this is something that is very
> simple to do with Mathematica or Maple. But right now I only
> need it for a couple of equations so I'd prefer not to have to learn

> Mathematica (or do it by hand). Thanks, --Wayne

At the risk of telling you precisely what you asked not to hear,
the amount of Mathematica you would need to learn in order to solve
this is miniscule. I expect all you would need to do is type
in the equations and call "Simplify[y']".

It'd almost certainly be faster than pencil and paper or the binomial
theorem. I'd be happy to walk you through the syntax if you change
your mind...

- Marshall
