
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

$$(a+b)^n = \sum_i b^i \text{binomial}(i,n) * a^{n-i} * b^i$$

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
 $\text{factorial}(n)/(\text{factorial}(j)*\text{factorial}(n-j))$

Ciao,
Paolo
