PSEUDO-DIFFERENTIAL CALCULATION

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Pseudo- Derivatives

Abstract: **Pseudo derivatives**. This is a kind of derivation that I apply to polynomials with several variables of degree n.

Such that the set of solutions of the system of pseudo derivatives of a polynomial P, belong to the set of solutions of the polynomial P.

With this very powerful mathematical tool, I manage to solve :

-an infinity of Diophantine equations

-The equations of higher degrees

-systems of linear and nonlinear equations with several variables

Finally, this calculation allows me to question the notion of 0/0.

PSEUDO-DIFFERENTIAL CALCULATION

Definition: Let be a polynomial with two real or complex variables $P(x,y)$ The pseudo derivatives of $P(x,y)$, with respect to x and with respect to y are defined as follows:

$$\forall (x,y) \in \Re; \forall A_{ji} \in \Re; \forall P(x,y) \in \Re$$

$$P(x,y) = \sum_{j=0}^{n-1} \sum_{i=0}^{n-j} A_{ji} x^{n-j-i} y^i = 0..........(1)$$

The pseudo derivatives noted $p\frac{\partial P(x,y)}{\partial x}$; $p\frac{\partial P(x,y)}{\partial y}$ are

$$\begin{cases} p\frac{\partial P(x,y)}{\partial x} = \frac{\sum_{j=0}^{n-1} \sum_{i=0}^{n-j-1} (n-i-j) A_{J(i+1)} x^{n-i-j-1} y^i}{n-j} = 0 \\ p\frac{\partial P(x,y)}{\partial y} = \frac{\sum_{j=0}^{n-1} \sum_{i=0}^{n-j-1} (i+1) A_{J(i+1)} x^{n-i-j-1} y^i}{n-j} = 0...........(2) \end{cases}$$

The zeros of system (2) are the same as those of equation (1)

Demonstration:

$$\forall (x,y) \in \Re; \forall A_{ji} \in \Re; \forall P(x,y) \in \Re : xp\frac{\partial P(x,y)}{\partial x} + yp\frac{\partial P(x,y)}{\partial y} = 0$$

This theorem is valid regardless of the number of variables.

Note 1: For n and m integers, the pseudo-derivatives of $(x^n y^m)$ with respect to x is: $\frac{nx^{n-1}y^m}{n+m}$, and with respect to y is $\frac{mx^n y^{m-1}}{n+m}$

The pseudo-derivatives of dx^0; d real or complex is : $\frac{0x^{-1}}{x} = \frac{1}{x} \Rightarrow \frac{0}{0} = 1$

The pseudo-derivatives of $x^0 y^0$ with respect to x is:

$$\frac{0x^{-1}y^0}{0+0} = \frac{0x^{-1}y^0}{2*0} = \frac{1}{2x} \Rightarrow \frac{0}{2*0} = \frac{1}{2} \Rightarrow \frac{0}{0} = 1$$

With respect to y is :

$$\frac{0x^{-1}y^{0}}{0+0}=\frac{0x^{0}y^{-1}}{2*0}=\frac{1}{2y}\Rightarrow\frac{0}{2*0}=\frac{1}{2}\Rightarrow\frac{0}{0}=1$$

The pseudo - derivative of a polynomial $P(x)$ with respect to x is: $\frac{P(x)}{x}$

That of P(y) with respect to y is: $\frac{P(y)}{y}$

Note 2: The pseudo-derivatives of a real number (a) with respect to x is $\frac{a}{x}$, and with respect to y is $\frac{a}{y}$

Example 1: let be the polynomial with two variables x, y following:

$$P(x,y)=x^{2}-2xy+2y^{2}+2x+3y=0........(1)$$

$$\begin{cases} p\dfrac{\partial P(x,y)}{\partial x}=x-y+2=0 \\ p\dfrac{\partial P(x,y)}{\partial y}=-x+2y+3=0 \end{cases} \quad S=(-7;-5)$$

These solutions belong to the solutions of equation (1).

Example 2: let be the polynomial with three variables x, y, z following:

$$Q(x,y,z)=x^{2}+y^{2}-z^{2}+4xy-2xz+4yz+2x-y-2z=0.......(2)$$

$$\begin{cases} p\dfrac{\partial Q(x,y,z)}{\partial x}=x+2y-z+2=0 \\ p\dfrac{\partial Q(x,y,z)}{\partial y}=2x+y+2z-1=0 \\ p\dfrac{\partial Q(x,y,z)}{\partial z}=-x+2y-z-2=0 \end{cases}$$

$S=(-2;1;2)$ These solutions belong to the solutions of equation (2).

Example 3: in this example we will make the 0/0 appear

$$P(x,y)=x^2-4xy+4y^2+5x-3y+dx^0-dy^0$$

$$\begin{cases} p\dfrac{\partial P(x,y)}{\partial x}=x-2y+5+\dfrac{d}{x}=0 \\ p\dfrac{\partial P(x,y)}{\partial y}=-2x+4y-3-\dfrac{d}{y}=0 \end{cases}$$

see (a)

Important note 3: the zero can be written as being : 1-1; or 2-2

Or d-d, or x^0-y^0 or, dx^0-dy^0 , d real or complex number.

The pseudo derivative of : $dx^0=\dfrac{0x^{-1}}{0}=\dfrac{1}{x}\Rightarrow\dfrac{0}{0}=1$

let's take $d=\alpha xy$, α real or complex number

$$\begin{cases} p\dfrac{\partial P(x,y)}{\partial x}=x-2y-5+\dfrac{\alpha xy}{x}=x-2y-5+\alpha y=0 \\ p\dfrac{\partial P(x,y)}{\partial y}=-2x+4y-3-\dfrac{\alpha xy}{y}=-2x+4y-3-\alpha x=0 \end{cases}$$

$$\begin{cases} p\dfrac{\partial P(x,y)}{\partial x}=x+(\alpha-2)y-5=0 \\ p\dfrac{\partial P(x,y)}{\partial y}=-(\alpha+2)x+4y-3=0 \end{cases}$$

let's take $\alpha=1$

$$\begin{cases} p\dfrac{\partial P(x,y)}{\partial x}=x-y+5=0 \\ p\dfrac{\partial P(x,y)}{\partial y}=-3x+4y-3=0 \end{cases} \quad S=(-17;-12)$$

Example 4: $P(x,y)=11y^3+2xy-15x+7y-23=0$

We take the following variable change : $\begin{matrix} x=X+k \\ y=Y+\lambda \end{matrix}$ k,λ real or complex

$$P(X,Y)=11Y^3+33\lambda Y^2+33\lambda^2 Y+2XY+2\lambda X+11\lambda^3+2KY+2K\lambda-15X$$
$$-15K+7Y+7\lambda-23=0$$

Let's take : $11\lambda^3+7\lambda-23+(2\lambda-15)K=0 \Rightarrow \lambda=7;K=3799$

We replace the values of k,λ in $P(x,y)$

$$P(X,Y)=11Y^3+231Y^2+5425Y+2XY-X=0$$

Let's calculate the pseudo derivatives:

$$\begin{cases} p\dfrac{\partial P(X,Y)}{\partial X}=Y-1 \\ p\dfrac{\partial P(X,Y)}{\partial Y}=11Y^2+231Y+9222+X=0 \end{cases} \qquad X=-9464;Y=1$$

Let's calculate the values of $x;y$

$$x=X+K \Rightarrow x=X+3799 \Rightarrow x=-9464+3799=-5665$$
$$y=Y+\lambda \Rightarrow y=Y+7 \Rightarrow y=1+7=8$$

$$S=(-5665;8)$$