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IMPACTS OF SENSITIVITY IN ADVANCED CONTROL SYSTEMS. DESIGNING A MODEL. GENERATION OF A INFLUENTIAL VALUES AND QUANTIZATION NOISE

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Impacts of Sensitivity in Advanced Control Systems. Designing a Model. Generation of a Influential Values and Quantization Noise

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Abstract - Different levels of impact to some phenomena that perceive and react to unexpected values affect the results to deviate and take inappropriate values. Our effort is to create relevant solutions, which will allow these values to minimize or recovered through analytical analysis and arithmetic expressions, which create a new condition, and affects the extreme values retrospectively. Extreme values (Max and Min) can be a part of a certain differential, which gives us the opportunity to explore the new created situation. By creating the appropriate model not only affects the performance of the model/algorithm, but also provides specific solutions at the expense of increasing of the accurate perception and creation of a certain range of values, that form the totality of the realization of a phenomenon in terms of an event is stochastic or defined in border.

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I. Introduction

To analyze events and on the basis of this analysis to establish a correct level of assessment is a demanding job and sometimes and is a tedious job. The events that are defined are strictly defined in a certain range of values. This means that the definition and deterministic definition opens the possibility of revaluation based on new values and visible results. However, the situation changes when events are random and stochastic. Our effort is to create a deterministic system of random events. These values can be compared and to draw certain conclusions in accordance with the evaluation of the phenomenon and in accordance with the terms of certain analytical and mathematical arithmetic. We will give some explanation, and will put some aspects of the approach to this problem, which creates a good model for finding optimal values affecting that particular generation of these values to be defined and present further breaking down under the new situations that, in accordance with these findings provide new aspects in treatment of conditions for not defined events and stochastic. Sometimes the biggest problem in choosing a design problem lies in the balance condition, as an initial step for finding a certain solution; this equation will contains the entirety of the description of the phenomenon converted into algebraic expressions, differential expression etc [7] [8].

When the system under investigation rotates at very close to a uniform rate, as is common in speed-sensitive industrial applications, the effects of quantization on the differentiator output can exceed the actual velocity variation of the system under test [14]. Many additional error sources are introduced by imperfections in incremental encoders [7]. In the context of a digital differentiator, the predominant error is likely to be the differential nonlinearity caused by random variation of any particular encoder transition location from that expected of an ideal system.

II. Submission of a Problem and Creating a Dynamic Balance Condition

If is treated the problem of a random phenomenon and stochastic, then will be seen, the needs to do more analysis of sequences in series. This approach is sometimes hard, but creates a view for an event. But if such an event consider as part of a function which varies from time to time or from a position in a state, then isn't has a need to apply well-known series that deal with the decomposition of a function in part as the particular such as Taylor series, etc. Also, decomposition of functions on particular piece opens up the possibility of treating the particular oscillators.

Consider a generic function f(x), assumed sufficiently differentiable, such that the first derivative of f at any x is defined as:

$$\frac{df}{dx}(x) \equiv \lim_{\Delta x \to 0} \frac{f(x+\Delta x) - f(x)}{\Delta x} \qquad (1)$$

The simplest numerical approximation merely drops the limit, thereby approximating the derivative with a finite change of f over a finite Dx:

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$$\frac{df}{dx}(x) \approx \frac{f(x+\Delta x) - f(x)}{\Delta x} \tag{2}$$

This is called a finite difference approximation to df/dx. If we re-arrange (1) to solve for f(x+Dx) instead, we get an approximation that can be used for solving differential equations (as in Example #1):

$$f(x+\Delta x) \approx f(x) + \Delta x \cdot \frac{df}{dx} \tag{3}$$

It is a simple matter to drop the limit in application, but what are the consequences? How accurate is the approximation that results? Consider applying a Taylor Series expansion to find f(x+Dx) instead, assuming that all necessary derivatives exist:

$$f(x+\Delta x) \equiv f(x) + \Delta x \frac{df}{dx} + \frac{1}{2}\Delta x^2 \frac{d^2 f}{dx^2} + \cdots \tag{4}$$

In contrast to (3), the Taylor Series expansion (4) is exact, but only at the price of an infinite number of terms. Of course we could stop at a finite number of terms instead by using a remainder term.

Where x∊[x,x+Dx]. This isn't an improvement for practical applications, since the location of x is not explicitly known, only its domain. Re-arranging (4), we get [3]:

$$\frac{df}{dx} \equiv \frac{f(x+\Delta x) - f(x)}{\Delta x} - \frac{1}{2}\Delta x \frac{d^2 f}{dx^2} - \frac{1}{3!}\Delta x^2 \frac{d^3 f}{dx^3} \ldots \tag{5}$$

Comparing (2) and (6), we can easily derive an exact expression for the error incurred by using finite differences to approximate df/dx rather than the full limit [3]:

$$Error \equiv -\frac{1}{2}\Delta x \frac{d^2 f}{dx^2} - \frac{1}{3!}\Delta x^2 \frac{d^3 f}{dx^3} \ldots \tag{6}$$

This is often referred to as the true error of the approximation. The error expression (7) is also not of practical use for actually computing a numeric value; since none of the derivatives are known. However the expression does allow some insight into the convergence of the approximation [4].

The idea of convergence is extremely important, for this process of refining the values of Dx is the only means of improving this particular approximation.

III. What I've Presented Above Function?

For dissolution in basic components, we will create new oscillators, at any moment we can find appropriate values under certain harmonics. For analyze is needed only the second harmonic/ member of Taylor series. Usually, the first part is a DC (direct current)-component. To do this step, and to be more applicative, we can do the following steps, which are important in aspects of practical implementations. In the next step, we can analyze a parametric expression, which function is very easily to be implemented in all aspects [1][3][4].

If we analyze the case of any parametric equation such as:

$$f(t) = at^5 + bt^4 + ct^3 + dt^2 + et \tag{7}$$

The first derivative of this function (8) is:

$$f'(t) = \frac{df}{dt} = \frac{d}{dt}(at^5 + bt^4 + ct^3 + dt^2 + et\ ) = 5at^4 + 4bt^3 + 3ct^2 + 2dt + e \tag{8}$$

Where a, b, c, d, e are the first polynomial coefficients, if the above expression will be derived and take certain parameter values, then we get equation (8) from which we can form the following table to find dilatation of a derived members of the equation (8).

$\mathbf{f(t)}$	$\mathbf{at^5}$	$\mathbf{bt^4}$	$\mathbf{ct^3}$	$\mathbf{dt^2}$	$\mathbf{et}$
$\mathbf{f'(t)}$	$5at^4$	$4bt^3$	$3ct^2$	$2dt$	e

Table. 1: Influetial values

Is needed only polynomial members and coefficients and its parameters values for finding influential values (like max and min).If the values of parameters are t: [0 ... 9 ... n], then:

$\mathbf{f'(t)}$, if a=b=c=d=e=1	$\mathbf{5at^4}$	$\mathbf{4bt^3}$	$\mathbf{3ct^2}$	$\mathbf{2dt}$	$\mathbf{e}$
Për t=0	0	0	0	0	0
t=1	5	4	3	2	1
t=2	90	24	12	4	2
t=3	405	108	27		
t=8	...	...	...	...	...
t=9	32805	2916	243	18	9
...	...	...	...	...	...
t=n	...	...	...	...	...

Table.2 : Values of the parameters of a fifth degree polynomial. Dilatation values with increasing value of a t parameter

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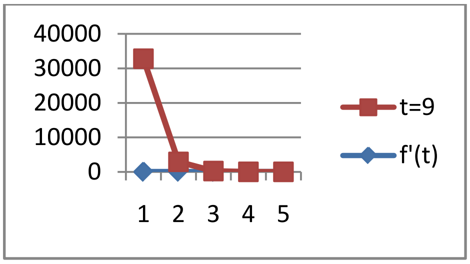

Fig.1 : t=9 dilatation of values

When we want to find extreme values of the function, such as:

$$f'(t) = 5at^4 + 4bt^3 + 3ct^2 + 2dt + e, \qquad (9)$$

then in this equation must find a roots. To find a roots is needed to find following equation.

$$f'(t) = 5at^4 + 4bt^3 + 3ct^2 + 2dt + e = 0 \qquad (10)$$

To make certain values arbitrarily we take the values a = b = c = 1 and d = 3, e = 2, and obtained this equation:

$$f'(t) = 5t^4 + 4t^3 + 3t^2 + 6t + 2 = 0 \qquad (11)$$

$$f'(t) = (t + 1)(t^3 - t^2 + 4t + 2) = 0 \qquad (12)$$

For $(t + 1) = 0$ and $(t^3 - t^2 + 4t + 2) = 0$- in this form is obtained zero function, and they are extreme values of this function, because the first expression is a differential. The obtained values from example t=1, etc, are the values that satisfy condition that a sensitivity, reaction and /or the power of a device are in maximum level.

In this illustration we can generalize this step:

So, is possible to find any maximum values of the sensitivity of sensitive equipment such as sensors. Those values can be generalized using the inductive method, as shown in the above case. Illustrations and the above analysis are used to specify and to make design and modeling of an advanced control system [6][9][12].

Results with extreme and influence values will be used for analysis a signal action in the input, and in the next step to be compared by quantization noise (signal to noise ratio-S/N). Obtained expressions for parametric functions are to guide a creation of influential values.

However, in the following section we will analyze the specifically designed model and relevant formulas to achieve maximum value in generally aspects

IV. Impacts of Sensitivity in Advanced Control Systems, Creating a Sensibility and Decreasing a Quantization Noise

In Fig.2 is shown a model/algorithms of a modulator which is affected by quantization noise. The concept of noise shaping is best explained by considering the frequency domain, where ∑Δ -Is a simple modulator or block scheme [11] [12]. In the below algorithm we can apply all the rules from the Control Theory [3][4].

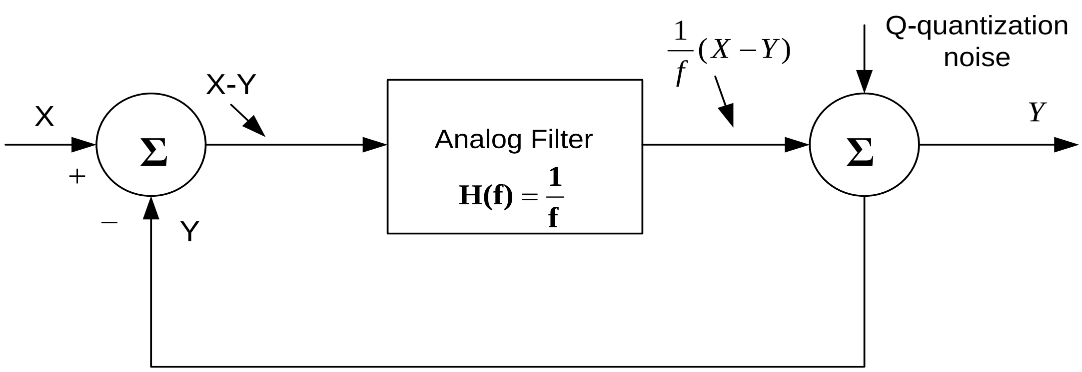

Fig. 2 : Design of model of modulator, impact of a sensitivity and quantization noise transmission function of this algorithm or model is:

$$Y = \frac{1}{f}(X - Y) + Q \qquad (13)$$

And by grouping by Y, will be obtained the following expression:

$$Y = \frac{X}{f+1} + \frac{Qf}{f+1} \qquad (14)$$

X-input signal and Y-output signal

Where, $\frac{X}{f+1}$- this member represent the signal, and $\frac{Qf}{f+1}$-the members represent the noise

If we derive the following expressions through frequency, we get:

$$\frac{dY}{df} = 0 \,, \; \frac{dY}{df} = \frac{d}{df}\left(\frac{X}{f+1} + \frac{Qf}{f+1}\right) = \frac{-X}{(f+1)^2} + \frac{Q}{(f+1)^2}$$

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To gain zero value for $\frac{dY}{df} = 0$, is needed a following condition:

$$X = Q \tag{15}$$

Quantization noise Q, is equal with X, where X is input signal.

This conclusion is very interesting and very important, because is a mathematical conclusion and confirms that the extreme value (maximum) transmission function in the formula (14) is always maximum when the input signal and quantization noise are equals. This generalization and this result give us the ability to always measure the values of input signal and quantization noise measure.

If X = Q, this means that we must be careful to not deviate one maximum value function of allowed and given transmission frequency band.

Also, the maximum values have the opportunity to establish frameworks and generation of frequencies that do not exceed the extreme values, and the system remains stable.

The integrator in the modulator is presented as a filter with low conversion and transmission function is: $H(f) = 1/f$. Transmission function depends on the frequency. Thus, with increasing frequency, then decreases H (f).This signal is multiplied by the filter transmission function, $1/f$. In the The following expression we will write output voltage Y as:

$$Y = \frac{1}{f}(X - Y) + Q \tag{16}$$

This expression can be regulated, and be thus:

$$Y = \frac{X}{f+1} + \frac{Q \cdot f}{f+1} \tag{17}$$

From the last formula we can draw the conclusion that: If frequency f is close to zero, and if we have no noise component, then the output signal Y is approximately equal with input signal X. At very high frequencies, the amplitude of the signal component decreases, while the noise component increases. So at high frequency, the signal output consists mainly of quantizing noise. In essence, the analog filter has the effect of low crossing signal, and effect of passing high quantization noise.

The work reported in this paper is also of importance because it indicates that the methods of analysis commonly applied to quantized data acquisition systems and sigma–delta modulators have relevance to sensor modeling. Conversely, the results derived in this paper can be applied to such systems [8].

Digital differentiation is intrinsic to the operation of the single-loop sigma–delta modulator. The quantization error resulting from application of a dc input to such a converter is identical to that which results when a constant-rate signal is uniformly quantized, the difference between two successive Discrete samples of the quantize output providing an estimate of the actual signal rate [10].

V. Program For The Impact of The Sensitivity and Coordinated Movement Under a Certain Direction

Creating a sensing and simulation Program by impact of sensitivity

```
#include "WPILib.h"
SensorDrive drivetrain(1, 2);
Device leftStick(1);
Device rightStick(2);
class SensorDemo : public SimpleSensor
{
        SensorDemo(void)
        {
                GetWatchdog().SetEnabled(false);
                }
                void Autonomous(void)
                {
                        for (int i = 0; i < 4; i++)
                        {
                        drivetrain.Drive(0.5,   0.0);   //
                        drive 50% forward, 0% turn
                        Wait(2.0); // wait 2 seconds
                        drivetrain.Drive(0.0,   0.75);  //
                        drive 0% forward and 75% turn
                        Wait(0.75); // turn for almost a
                second
                        }
                        drivetrain.Drive(0.0,   0.0);   //
                stop the devices
                        }
                        void OperatorControl(void)
                        {
                while (1) // loop forever
                        {
                        drivetrain.Tank(leftStick,
                        rightStick); // drive with the
                        sensor
                        Wait(0.005);
                        }
                }
        };
START_SENSOR_CLASS(SensorDemo);
```

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Although, this program will work perfectly with the sensor as described in this example drivetrain and stick are global variables. The drivetrain.Drive() method takes two parameters, a speed and a turn direction.

VI. Conclusion

The deterministic definition opens the possibility of revaluation based on new values and visible results. However, the situation changes when events are random and stochastic. Our effort is a creating a new model, and treatment a deterministic system of random events. These values can be compared and to draw certain conclusions in accordance with the evaluation of the phenomenon and in accordance with the terms of certain analytical and mathematical arithmetic.

The conclusion confirms that the extreme value (maximum) of transmission function is always maximum when the input signal and quantization noise are equals. This generalization and this result give us the ability to always measure the values of input signal and quantization noise measure.

If $X = Q$, this means that we must be careful that: to not deviate a maximum value function of allowed transmission frequency band.

If the expression is not derived then, and if frequency f is close to zero and if doesn't has noise component, then the output signal Y is approximately equal to the input signal X. At very high frequencies, the amplitude of the signal component decreases, while the noise component increases. So at high frequency, the signal output consists mainly of quantizing noise. In essence, the analog filter has the effect of low crossing signal, and the effect of passing high quantization noise.

The results described are also applicable to a more general class of systems which involve the digital differentiation of quantized, noise-affected signals, such as first-order sigma–delta modulators with nominally constant input.

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