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LABVIEW APPLICATION FOR DIAGNOSIS BRAKING FAULT

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Abstract: The paper presents a LabVIEW application performed to determine errors simulated with Continental Teves MK 60 stand. This stand is a simulator which can be studied in the laboratory the brake system with ABS / ESP in Audi and Volkswagen vehicles. The stand allows the simulation of errors that occur in braking systems of these vehicles and the braking system performs diagnostics individual situation. Reading memory errors made using a tester. Tester connection is made via a 16-pin connector to standard VAG. Automatic diagnostics and fault memory read VCDS VAG-COM, are recommended VAG 5051 or VAG 5052 tester. Lacking such a tester, I realized the Labview software enabling fault diagnosis introduced this stand.
Keywords: connection, stand, simulator, standards, schedule, tester

1. INTRODUCTION

Continental Teves MK 60 stand is a simulator that can be studied braking system with ABS / ESP in composition Audi and Volkswagen vehicles, [5]. The stand allows the simulation of errors that occur in braking systems of these vehicles and the braking system performs diagnostics individual situation. Reading memory errors made using a tester. Tester connection is made via a 16-pin connector to standard VAG. Automatic diagnostics and fault memory read VCDs VAG-COM, are recommended VAG 5051 or VAG 5052 tester. Lacking such a tester, I realized the Labview software enabling fault diagnosis introduced this didactic stand.

2. THE STAND CONTINENTAL TEVES MK 60

Stand Continental Teves Mk 60 is used to study aggregate braking system diagnosis with ABS/ESP in laboratory conditions, similar braking system is fitted as Audi and Volkswagen vehicles. The stand is supplied with a 230 V connector and pedestal stand is 12 V power supply and vacuum pump. The power is the DC supply, voltage is 12 V, and output power of 200 W. The system is operated via a potentiometer for speed and maintained at the required speed performance diagnostics. On the stand are two brake pressure gauge indicating the first or the second circuit brake system, corresponding similar of Audi and Volkswagen vehicles. The brake pressure for each of the four wheels is also indicated by a pressure gauge. The friction coefficient can be changed using a potentiometer for each wheel. On the right side there is a box stall wall which measured signals by a multimeter or oscilloscope. Binding power of the four wheels is made via external connectors.

Possible fault simulation is accomplished acting 12 switches, each for a particular type of defect, [5]. In Figure 1 presents the didactic stand study braking system, found in the laboratory of "Construction and Calculation of Road Vehicles" in the Faculty of Engineering of Hunedoara.

3. FRONT PANEL AND SOFTWARE ACQUISITION SCHEME

In Figure 2 presents the front panel of LabVIEW applications designed and built to achieve diagnosis braking Continental Teves MK 60 stand, [2], [3].

In order to purchase signals on the right side wall of the stand there is a box to measure signals with a multimeter or oscilloscope. Acquisition and storing signals will be in 12 files. txt, for each type of error can be generated by booth staff. In order to achieve data acquisition board to use data acquisition, NI 6221, [4] and developed in LabVIEW software [1]. Thus, there are 12 channel analog input set, a sampling rate of 20 KHz / channel. By the 12-channel analog input acquisition board signals were taken as a vector, and each introduced fault, the program created a file type. Txt or writing the values received. The program runs once for each defect introduced. Saved file will contain 12 columns, each column there signal acquired from every possible defect in the part. Finally, will result in 12 files, each of 12 columns each. At the time of purchase, the software also offers a graphical view of the signal. Module configuration software for plotting the graph on acquisition signals shown in Figure 3. The fig. 4 shows the data acquisition software scheme designed for the diagnosis braking system with ABS / ESP, of the stand.

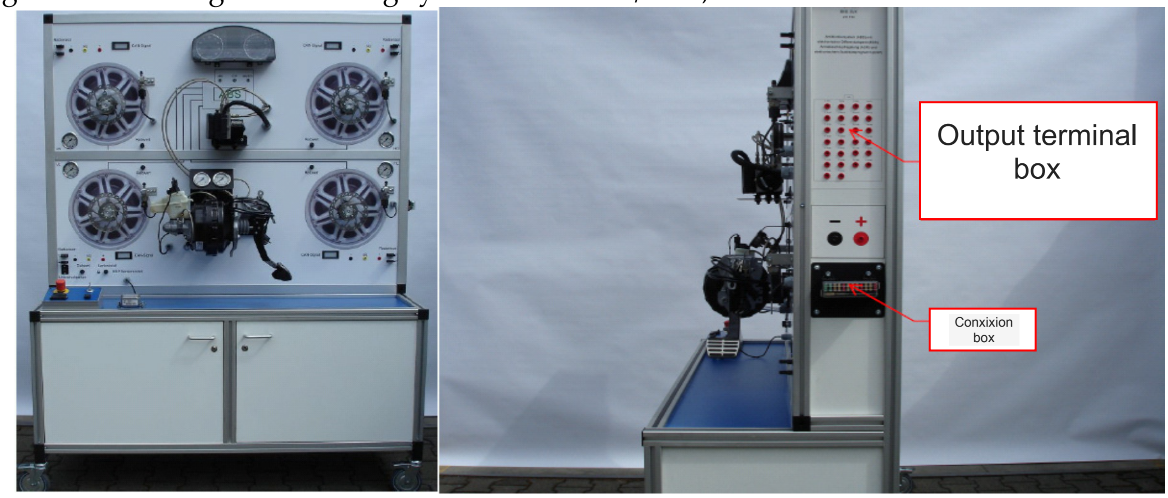

Figure 1. Continental Teves MK 60 stand for diagnosis brake system, [5]

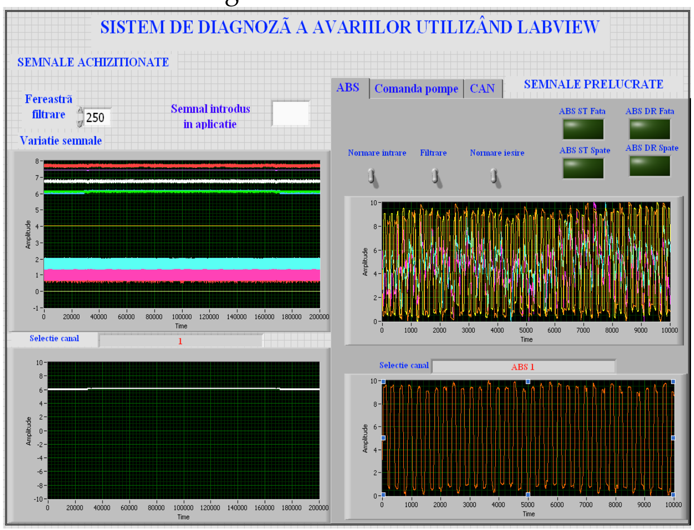

Figure 2. The frontal panel of the aplication

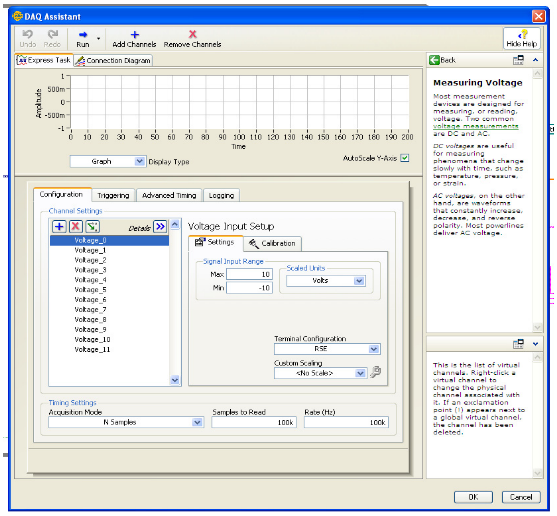

Figure 3. DAQ module's configuration

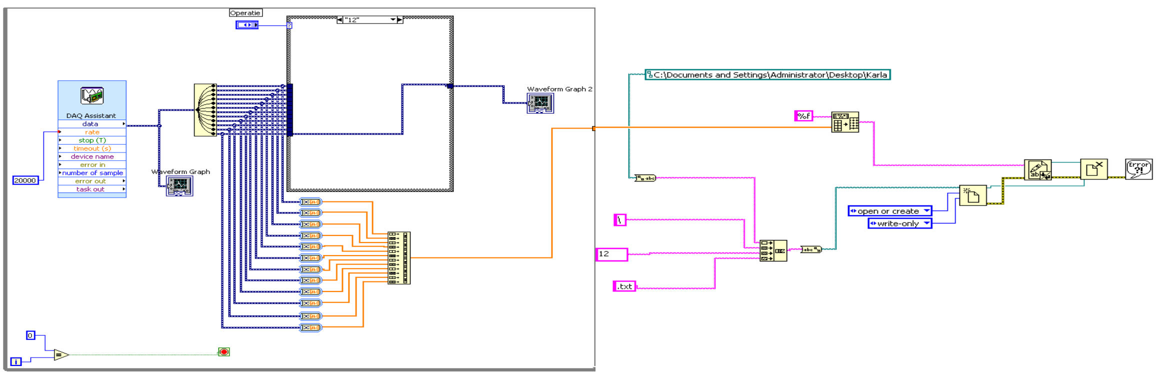

Figure 4. The data acquisition scheme

4. PLAYBACK APPLICATION

Playback application intended to diagnose brake system of Continental Teves MK 60 stand, similar to the braking system of the Audi and Volkswagen vehicles.

Normally this test stand can connect reading error codes from the controller which can determine the type of error. Lacking such a tester, I made a program in Labview to diagnose errors simulated by the stand. Figure 5 shows how to read the information in the file. The 12 acquired signals are fed into a structure of type "Array" . Matrix will file inputs values and matrix size. Matrix size was determined taking into account that the acquisition frequency was 20KHz / channel for 5 second , resulting in this way 100,000 samples. Acquired signals were displayed in graphs, shown in figure 6. It is noted that due to the shape of the signal and noise could not visually detect where the error occurred, no deviation is detected in normal mode. Thus, the signals have to be processe, to be able to diagnose faults. The 12 signals are of different types were handled individually according to their characteristics.

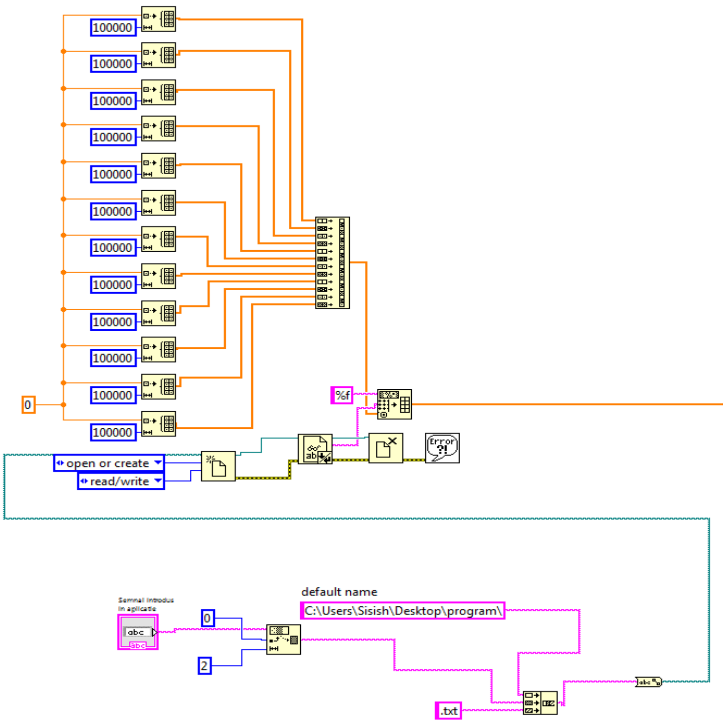

Figure 5. The way to read information from file

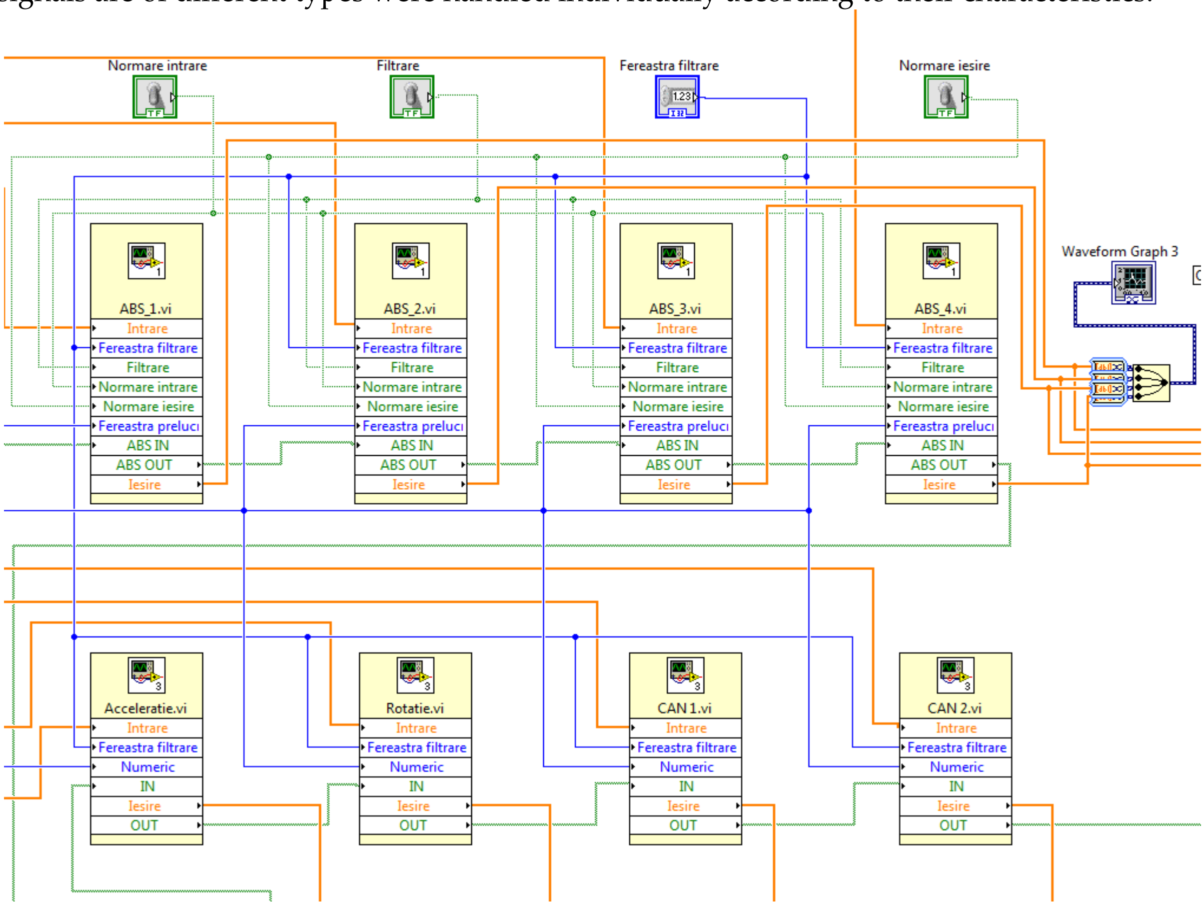

Figure 6. The way to display the acquired signals

The program used graphics loop "Case" in order to choose the signal that we want to view, figure 7.

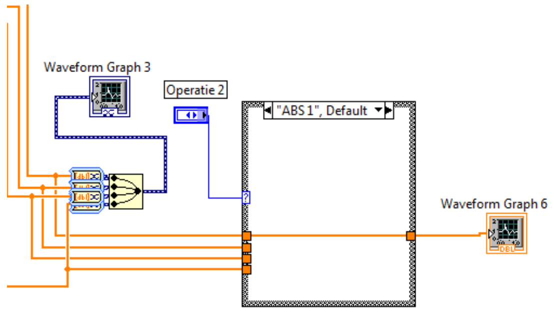

Figure 7. The way to use loop "Case" for choosing the desired signal

4.1 Signal Processing - Faulty speed sensor on four wheels

Because the signals acquired from the speed sensors were similar, the data corresponding to the first four error codes have been processed in the same way.

These errors are related to the speed sensor, as follows: G44-speed sensor rear right; G45 - right front speed sensor; G46-left rear speed sensor; G47 - left front speed sensor.

Acquired signal was normalized to input. Standardization consists in taking the signal, extracting the minimum and maximum, performance difference between the minimum and maximum value and the result is divided by 10. Acquired signal is multiplied by minus its minimum. The output of first normalization to be used for signal filtering, figure 8.

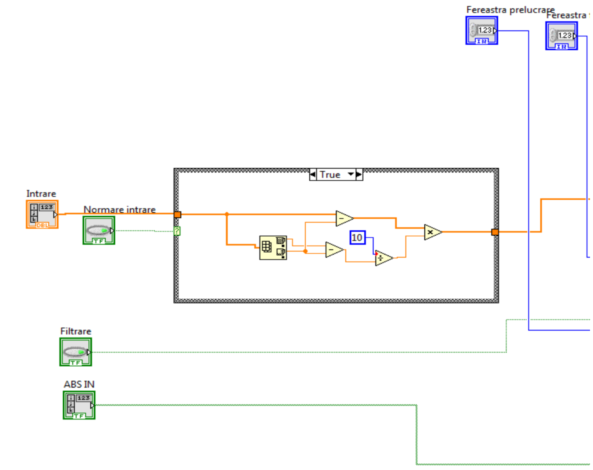

Figure 8. The data output by the speed sensor error detected in the first normalization, used to filter the signal corresponding to the fault in the one of the speed sensors

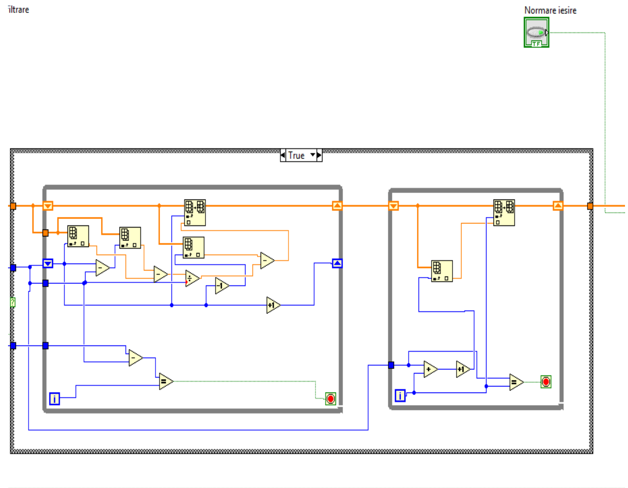

Figure 9. Filtering module corresponding to the defect signal from one of the speed sensors

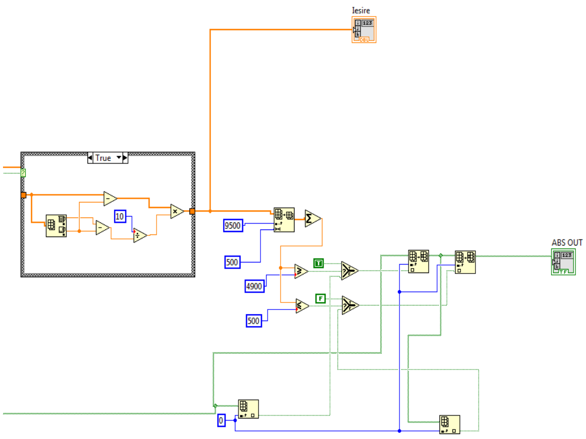

Figure 10. The way to achieve filtration in the corresponding defect output signal from one of the speed sensors

Filtering method used is based on calculating the average of input data samples in the window when "n" knowing the media data samples in the input window from the time "n-1", figure 10. To filter was used the formula: $y[n] = y[n-1] – \{x [n-k] –x [n] \}/k$, unde $k = 5$.

Finally it will achieve an output normalization that after filtering the signal to be analyzed, figure 10. Output standardization is done in the same way as at the entrance.

4.2 Signal Processing - Failure to supply acceleration sensor

In this case, the controller 25 reads times per second and the information received from sensors applied, if necessary, through the hydraulic modulator, the braking force to the wheels. Acceleration sensor is one of the elements that control the operation of ESP's. This signal was applied to the filter used for the aggregate ABS sensors. Filtering method used is based on calculating the average of input data samples in the window when "n" knowing the media data samples in the input window from the time "n-1". To filter was used the formula:

$$y[n] = y[n-1] - \{x[n-k] - x[n]\}/k, \text{ where } k = 5.$$

Next, is the sum of values, is divided by the number to give a mean value of the signal.

Through a "shift register" is subtracted from the mean value of the filtered signal, is squared and the root is extracted from the resulting product. There was thus obtained, the actual value of the signal, figure 11.

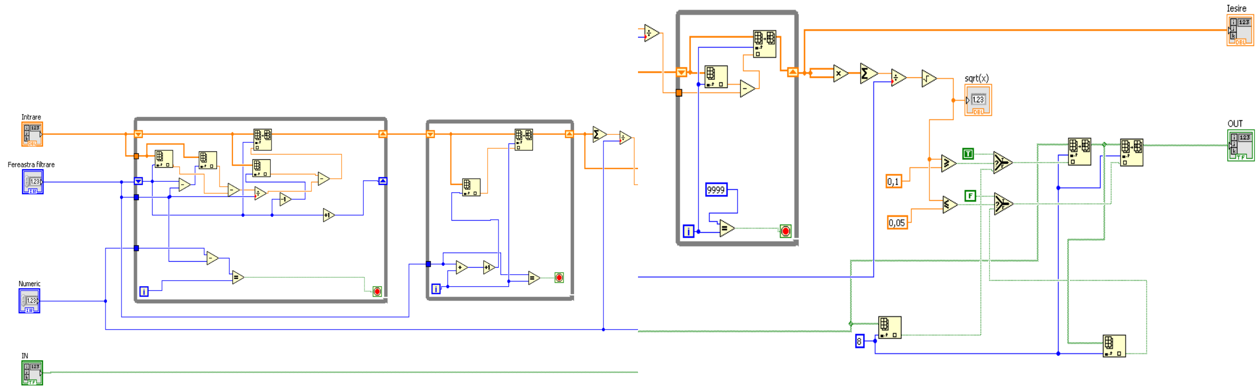

Figure 11. The way to obtain the actual value of the signal power corresponding acceleration sensor fault

4.3 Signal Processing - Failure to supply yaw sensor

Due to the fact that the signal is the same as the acceleration sensor, we used the same method for its processing. The signal has been filtered, brought the average value, figure 12, and then the actual value of this, is presented in figure 13.

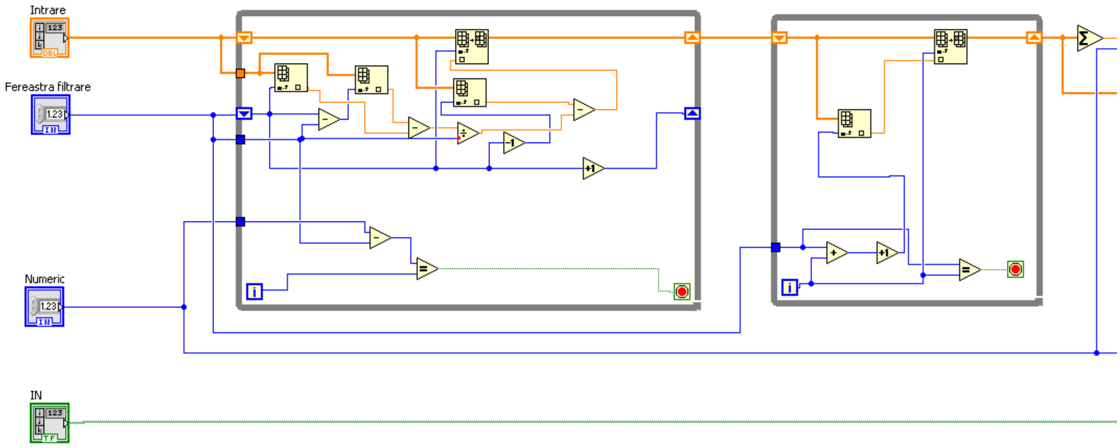

Figure 12. The way to obtain the average value of the signal power corresponding to the fault of yaw sensor

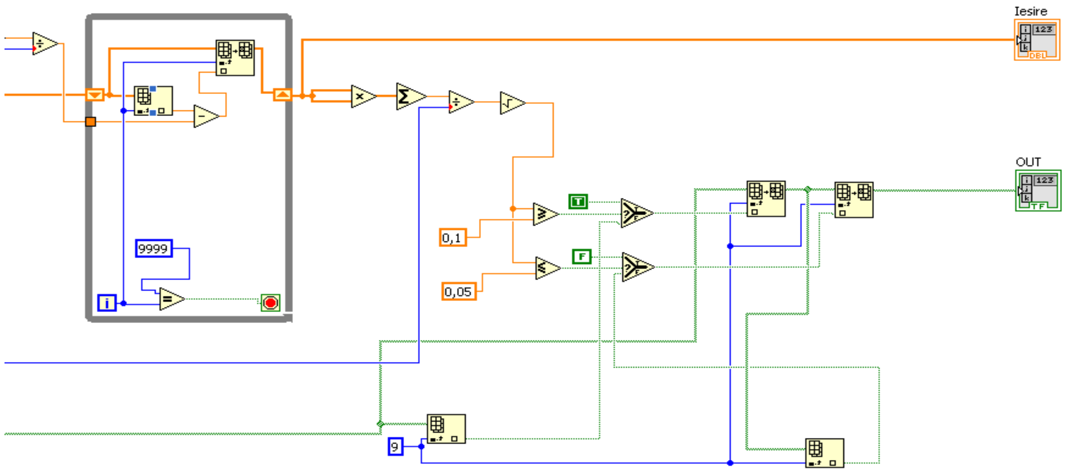

Figure 13. The way to obtain the actual value of the signal power corresponding to the fault of yaw sensor

4.3 Signal Processing - CAN1 and CAN2 Fault buses

This signal was applied to the filter used for the aggregate ABS sensors. Filtering method used is the same as that used in the processing of the power fault signal of the acceleration sensor, shown at point 4.2. Fig 14 shows how the average value of the signal obtaining properly simulate faults in buses CAN 1 and CAN 2, respectively in figure 15 how to obtain the actual value of the signal on the same bus.

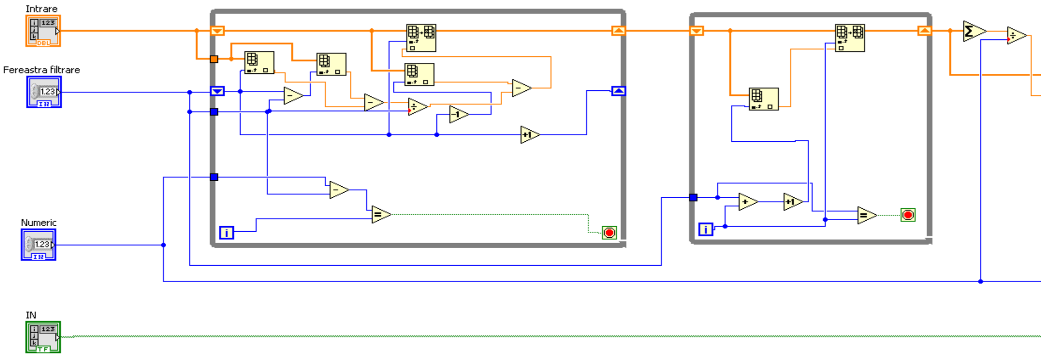

Figure 14. The way to obtain the average value of the corresponding fault signal buses CAN 1 and CAN 2

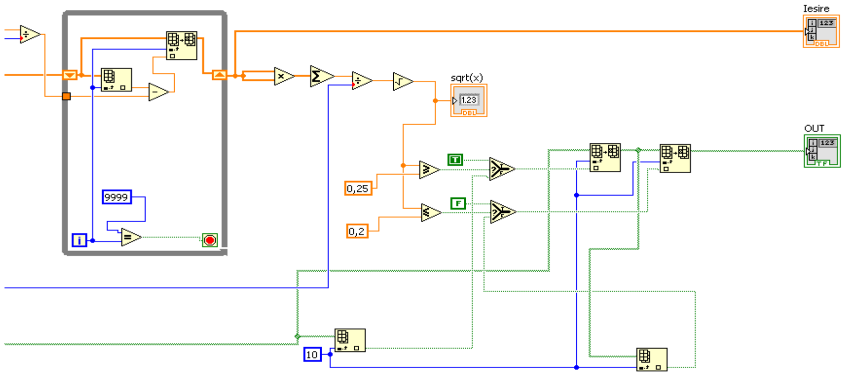

Figure 15. How to obtain the actual value corresponding fault signal buses CAN 1 and CAN 2

5.CONCLUSIONS

Application designed and built the experimental stand with ABS-ESP accompanying presented for the study and processing of signals generated by the 12 types of flaws that can be simulated Continental Teves MK60 stand.

In this way, students can familiarizing themselves with the application of acquisition signal processing and diagnosis of braking system with ABS / ESP similar with the brake system of Audi and Voskwagen vehicles.

Using virtual instrumentation technique ensures high precision measurements from conventional methods. It also substantially reduces the amount of equipment necessary and measured processing time measurements. During the measurements can watch the partial results already processed and on completion will be issued bulletins evidence of attempts to contain those dignosis conclusions.

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