

Black-Box Method for Analyzing Parameters of Permanent Magnet DC Motor

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ABSTRACT: This paper deals with the identification and diagnosis of the PMDC motor, by using Black-Box method. By using this method, the different parameters like sound, temperature, acceleration, current, voltage and speed of PMDC motor can be monitored and detect the faults before it occurs. The proposed method is independent of detailed internal parameters of PMDC motor. This method is implemented and simulated and the results are obtained in which observably increasing efficiency.

KEYWORDS: Permanent Magnet Direct Current Motor (PMDc), Black-Box Method, Diagnosis, Parameters.

I INTRODUCTION

In this project, we going to discuss about the analyzes of the different parameters like noise, vibrations, temperature, voltage, current and speed of the PMDC Motor. Due to a big change of load, a wide speed range, and the poor working conditions of the permanent magnet dc motor (PMDc) for electric vehicles, abnormal noise sources of the PMDC for electric vehicles are extremely abundant, and the sound quality of the PMDC for electric vehicles is very poor relative to that of the PMDC in other industrial applications. Therefore, a quick and effective method for identification and diagnosis of abnormal noise sources of PMDC for electric vehicles is needed.

II EXPLANATION OF BLOCK DIAGRAM

Figure 1 shows the PMDC motor with parameters. The PIC microcontroller controls all the programming to identify the current, voltage, speed, vibration and sound of the PMDC motors, which provides output voltage greater than, less than or equal to the input voltage.

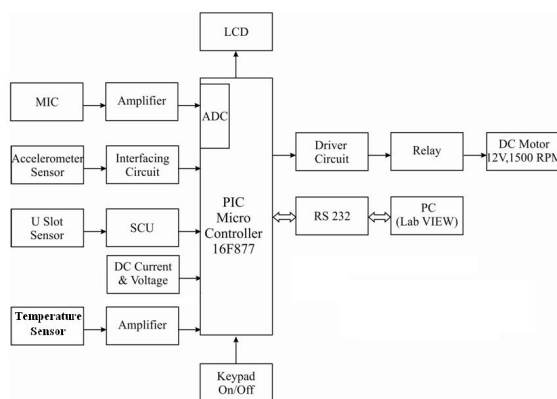


Figure: 1 Block diagram of proposed system

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2.1 Accelerometer

An accelerometer is an electromechanical device that will measure acceleration forces. These forces may be static, like the constant force of gravity pulling at your feet, or they could be dynamic - caused by moving or vibrating the accelerometer. An accelerometer is a device that measures the vibration, or acceleration of motion of a structure. The force caused by vibration or a change in motion (acceleration) causes the mass to "squeeze" the piezoelectric material which produces an electrical charge that is proportional to the force exerted upon it. Since the charge is proportional to the force, and the mass is a constant, then the charge is also proportional to the acceleration. There are two types of piezoelectric accelerometers (vibration sensors). The first type is a "high impedance" charge output accelerometer. In this type of accelerometer the piezoelectric crystal produces an electrical charge which is connected directly to the measurement instruments. The charge output requires special accommodations and instrumentation most commonly found in research facilities. This type of accelerometer is also used in high temperature applications (>120C) where low impedance models can not be used.

2.2 Temperature Sensor

The resistance of most common types of thermistor *decreases* as the temperature rises. They are called **negative temperature coefficient**, or **ntc**, thermistors. Note the $-t^\circ$ next to the circuit symbol. A typical ntc thermistor is made using semiconductor metal oxide materials. (Semiconductors have resistance properties midway between those of conductors and insulators.) As the temperature rises, more charge carriers become available and the resistance falls. Although less often used, it is possible to manufacture **positive temperature coefficient**, or **ptc**, thermistors. These are made of different materials and show an increase in resistance with temperature. How could you make a sensor circuit for use in a fire alarm? You want a circuit which will deliver a HIGH voltage when hot conditions are detected.

2.3 Microphone

Microphone is a device made to capture waves in air, water or hard material and translate them into an electrical signal. The most common design uses a thin membrane which vibrates in response to sound pressure, this movement being subsequently translated into an electrical signal. Most microphones in use today for audio use electromagnetic generation (dynamic microphones), capacitance change (condenser microphones) or piezoelectric generation to produce the signal from mechanical vibration.

III. PROGRAM CODING

```
#include<pic.h>
#include"pic_lcd8.h"
#include"pic_adc.h"

#define dac PORTB
#define relay RC0
#define but RC1
#define but1 RC2
#define but2 RC3

unsigned char v1,v2,v3,v4;

void main()
{
    TRISA=0x03;
    TRISB=0x00;
    TRISC=0x8E;
    TRISD=0x00;

    Lcd8_Init();

    Lcd8_Display(0x80,"- SPEED CONTROL",16);
```

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```
Lcd8_Display(0xC0,"-----SYSTEM----",16);

Delay(65000);Lcd8_Command(0x01);

    dac=240;relay=1;
Lcd8_Display(0x80,"PT1:      ",16);
Lcd8_Display(0xC0,"      ",16);
while(1)
{

    //dac=220;
    v1=Adc8_Cha(0);
    v2=Adc8_Cha(1);
    v3=Adc8_Cha(3);

    Lcd8_Decimal3(0x84,v1);
    Lcd8_Decimal3(0x8b,v2);
    Lcd8_Decimal3(0xc4,v3);
    Lcd8_Decimal3(0xcc,v4);
    Lcd8_Display(0x80,"CT=",3);Lcd8_Decimal3(0x84,v1);
    Lcd8_Display(0x87,"VOT=",4);Lcd8_Decimal3(0x8b,v2);
    Lcd8_Display(0xc0,"ACC=",4);Lcd8_Decimal3(0xc4,v3);
    Lcd8_Display(0xc8,"Tmp=",4);Lcd8_Decimal3(0xcc,v4);
    //Lcd8_Display(0xcc,"SPD=",4);Lcd8_Decimal3(0xd0,pro);

    if(but1==0)
        {dac=230;}
    if(but1==1){dac=200;}

    if(but==0)
        {relay=0;}
    if(but==1){relay=1;}

}
}
```

IV. MODELLING AND SIMULATION OF PMDC MOTOR IN PIC MICROCONTROLLER

4.1 MPLAB

MPLAB IDE is an integrated development environment that provides development engineers with the flexibility to develop and debug firmware for various Microchip devices MPLAB IDE is a Windows-based Integrated Development Environment for the Microchip Technology Incorporated PIC microcontroller (MCU) and ds PIC digital signal controller (DSC) families. In the MPLAB IDE, you can:

- Create source code using the built-in editor.
- Assemble, compile and link source code using various language tools. An assembler, linker and librarian come with MPLAB IDE. C compilers are available from Microchip and other third party vendors.
- Debug the executable logic by watching program flow with a simulator, such as MPLAB SIM, or in real time with an emulator, such as MPLAB ICE. Third party emulators that work with MPLAB IDE are also available.
- Make timing measurements.
- View variables in Watch windows.

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- Program firmware into devices with programmers such as PICSTART Plus or PRO MATE II.
- Find quick answers to questions from the MPLAB IDE on-line Help.

4.1.1 MPLAB SIMULATOR

MPLAB SIM is a discrete-event simulator for the PIC microcontroller (MCU) families. It is integrated into MPLAB IDE integrated development environment. The MPLAB SIM debugging tool is designed to model operation of Microchip Technology's PIC microcontrollers to assist users in debugging software for these devices

4.1.2 IC PROG

The PRO MATE II is a Microchip microcontroller device programmer. Through interchangeable programming socket modules, PRO MATE II enables you to quickly and easily program the entire line of Microchip PIC microcontroller devices and many of the Microchip memory parts.

PRO MATE II may be used with MPLAB IDE running under supported Windows OS's (see Read me for PRO MATE II.txt for support list), with the command-line controller PROCMD or as a stand-alone programmer.

4.1.3 COMPILER-HIGH TECH C

A program written in the high level language called C; which will be converted into PIC micro MCU machine code by a compiler. Machine code is suitable for use by a PIC micro MCU or Microchip development system product like MPLAB IDE.

4.1.4 PIC START PLUS PROGRAMMER

The PIC start plus development system from microchip technology provides the product development engineer with a highly flexible low cost microcontroller design tool set for all microchip PIC micro devices. Thepic start plus development system includes PIC start plus development programmer and MPLAB IDE.

The PIC start plus programmer gives the product developer ability to program user software in to any of the supported microcontrollers. The PIC start plus software running under MPLAB provides for full interactive control over the programmer.

4.2 PROTEUS

Traditionally, circuit simulation has been a non-interactive affair. In the early days, net lists were prepared by hand, and output consisted of reams of numbers. If you were lucky, you got a pseudo-graphical output plotted with asterisks to show the voltage and current waveforms.

More recently, schematic capture and on screen graphing have become the norm, but the simulation process is still non-interactive - you draw the circuit, press go, and then study the results in some kind of post processor. This is fine if the circuit you are testing is essentially static in its behavior e.g. an oscillator which sits there and oscillates nicely at 1 MHz. However, if you are designing a burglar alarm, and want to find out what happens when a would-be burglar keys the wrong PIN into the keypad, the setting up required becomes quite impractical and one must resort to a physical prototype. This is a shame, as working 'in cyberspace' has so much to offer in terms of design productivity.

Only in educational circles has an attempt been made to present circuit simulation like real life electronics where it is possible to interact with the circuit whilst it is being simulated. The problem here has been that the animated component models have been hard coded into the program. Only limited numbers of simple devices such as switches, light bulbs, electric motors etc. have been offered, and these are of little use to the professional user.

In addition, the quality of circuit simulation has often left much to be desired. For example, one major product of this type has no timing information within its digital models.

PROTEUS VSM brings you the best of both worlds. It combines a superb mixed mode circuit simulator based on the industry standard SPICE3F5 with animated component models. And it provides an architecture in which additional animated models may be created by anyone, including end users. Indeed, many types of animated model can be produced without resort to coding. Consequently PROTEUS VSM allows professional engineers to run interactive simulations of real designs, and to reap the rewards of this approach to circuit simulation.

And then, if that were not enough, we have created a range of simulator models for popular micro-controllers and a set of animated models for related peripheral devices such as LED and LCD displays, keypads, an RS232 terminal and more. Suddenly it is possible to simulate complete micro-controller systems and thus to develop the software for them

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without access to a physical prototype. In a world where time to market is becoming more and more important this is a real advantage.

It is also worth pointing out that the processing power of the modern PC is truly awesome. A 300MHz Pentium II PC can simulate simple micro-controller designs in real time, or even faster in some cases.

And even where things slow down somewhat, the response time is more often than not useable for software development.

If you are serious about this game, you can go out and buy a 2GHz dual processor PC, which is far, far faster. This, then, debunks the other obvious objection to interactive simulation - which it would not be fast enough.

4.1 Simulation Model Of The Black-box of PMDC motor with six parameters

The simulation model of the system with six parameter are implemented in PROTEUS and the simulation is successfully done. The simulation model of the system is shown in figure

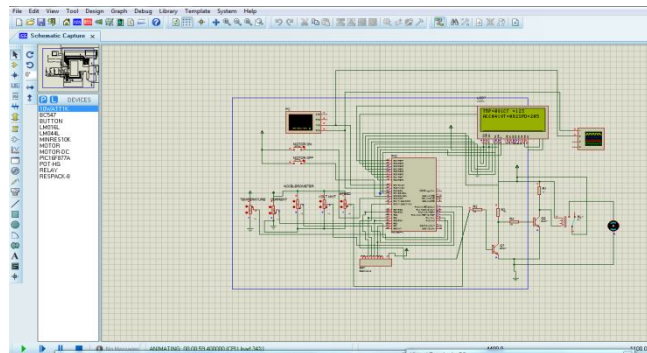


Figure: 2S imulation model of proposed systems

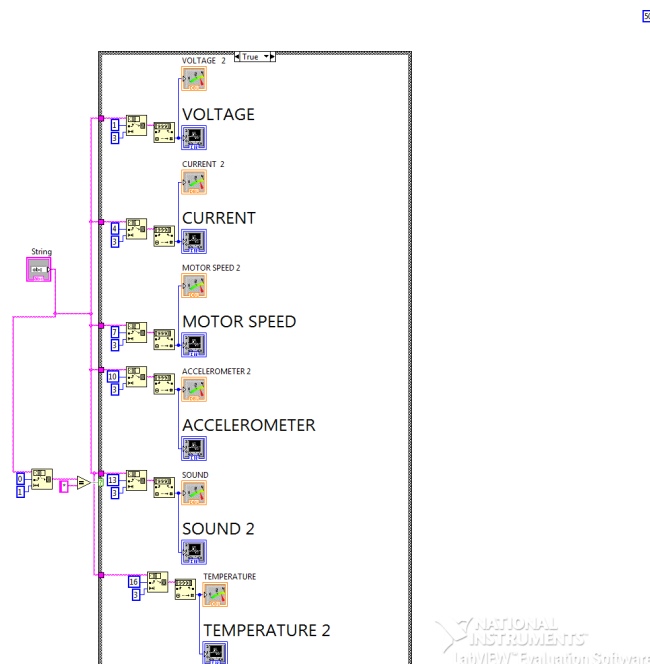


Figure : 3 Internal working of output

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Thus the models are designed in PROTEUS with various available components of Six Parameters. The simulation is done successfully for the above models and the outputs are generated.

V. SIMULATION RESULTS AND DISCUSSION

The simulation is done for the PMDC motors,



Figure 3 Output Power of Voltage current and sound

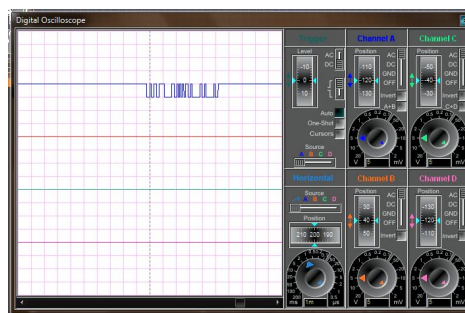


Figure 4 Output of accelerations with voltage and current

The Proteus software, overall block diagram and simulation model of the proposed system was discussed in detail. It also focuses on advantages of using Proteus for modeling the system, and system specification of proposed system. The detailed function of the various blocks used in the system was understood with this knowledge the same system can be modeled with the help of Proteus software tool and its respective output block diagrams used in the proposed system is discussed in detail.

5.1 Comparative Result Of digital And virtual output

The Digital and Virtual results are compared and it is shown in figure 5,6

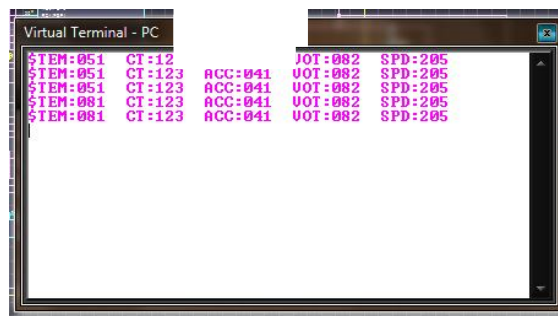


Figure 5 virtual display output

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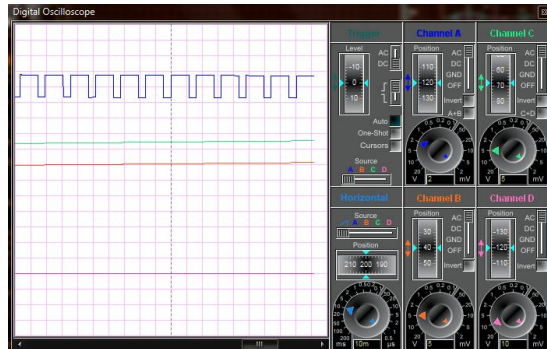


Figure 6: digital display output

Thus the results are compared with two displays and incremental efficiency provides better output with reduced oscillation.

S

5.2 Simulation Result Of PMDC motor

The simulation for the Fuzzy Logic Control algorithm model is discussed in 4.5 is done and the results are discussed. The power, voltage output waveforms to the converter from the PMDC motor is shown in figure 22

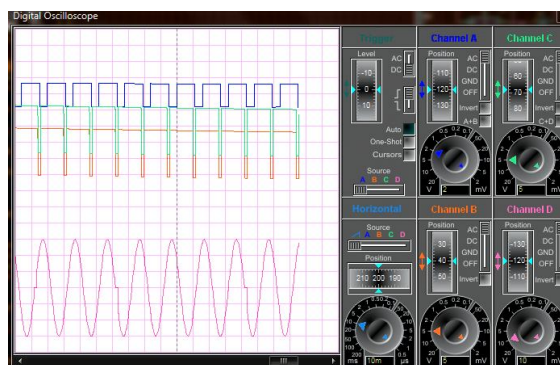


Figure 7: output circuit of simulation

From the results of the system, it is clear that the output is constant. The oscillations in the output components are very much lesser. The waveforms obtained in the different scopes have been shown above for all models.

It has faster response and it has advantages of environmental friendly, robustness and convenience.

The simulation produces the best result without any overshoots and settles at the voltage with reduced oscillations. So this method is very effective and it can be used for many applications like cars, industries, etc renewable energy like solar plays very important role in meeting the demand, the outcome of the parameters on the black-box method implemented to meet the demand requirement.

VI. CONCLUSION

A black-box method for identification and diagnosis of the abnormal noise sources of PMDC motors has been proposed in this paper. The black-box testing model and experiment are analyzed in detail. Sound quality of PMDC Motor is assessed with both psychoacoustic indicators and objective acoustic indicators. In the end, abnormal noise sources are properly identified and diagnosed by analyzing the rotational speed signal and the noise signal. The black box modeling does not need internal parameters of PMDC Motors and also identified the parameters like speed, current, voltage, vibration, temperature. Comparing with the white-box method; the proposed black box method in this paper simplifies analysis procedures and remarkably improves efficiency

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