Design And Testing of Wiring Harness on Test Rig – A Review

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Abstract- *As the automobiles have various peripherals, they are dependent on wire harness. Hence, it becomes necessary to ensure the 100% working of the harness for the better and expanded life of the automobile. After completing the literature survey, various methods used to design the harness and testing are studied.. The studied methodology involves using of various computer software used for designing and testing the wire harness.*

Keywords- Automobiles, Harness design, Computer software.

I. INTRODUCTION

Most of the wiring designs were done manually and it was a trial and error method to check and test the harness. With the huge expansion in electrical requirements wiring designs has become more complicated to design manually.

Due to expanding electronic features in most equipment, the role of the wire harness is becoming more prominent in many manufacturing fields. The wire is the heart of the functioning automobile. Hence, the functioning of the harness is the most important aspect. Furthermore, wire harness assembly is certainly one of the most difficult and time-consuming phase in manufacturing.

Wiring harness connection test is the basic checkout item of ensuring the quality and reliability of wiring harnesses. The testing process necessary to remove the errors in manufacturing and ensure quality goods to the consumers.

We can eliminate the early invalid product such as the product of short or open circuit, miswiring, bad connection and instant open circuit to improve the product quality. We design a Test rig to test wiring harness faults. The designing of the test-rig is also a key component in manufacturing of the wire harness. The harness is manufactured according to the needs and wire layout diagram given by the consumer or manufacturer.

II. LITERATURE REVIEW

To understand the process of harness design and various advancements in the field of harness design various papers were studied. Multiple papers that explain the automation involved in the process of designing the wiring harness for automobiles.

The papers studies for the review are:

[1] “Automation of Electrical Cable Harnesses Testing”.

The modularization concept is applied to automate the testing processes of cable harnesses for a SME. The aim of modularization is to decouple the complexity of mechanical, electrical and electronic, and control components. The proposed system is developed, and the comparable study of manual and automated testing is conducted. The testing experiments have shown that the automated system outperformed manual operations greatly in terms of cost saving, productivity and reliability

[2] “High-Strength Aluminum Wires for Low- Voltage Automotive Engine Wiring Harnesses”.

Development of high-strength aluminum wire for automotive wiring harnesses with the aim of reducing their weight and costs. The wire uses a high-strength aluminum alloy conductor with a strength equivalent to or greater than that of copper. These features make the wire applicable to engine compartments and allow it to reduce in the size to 0.35 mm2 that has high-strength and high resistance to engine vibration

[3] “Design And Implementation of CAN bus Protocol for Monitoring Vehicle Parameters”:

CAN bus is a serial bus protocol used in most automotive industries. CAN bus technology is adopted in modern vehicles to reduce the wiring harness and controls the vehicle using electronics system. Using Raspberry Pi to implement a CAN bus system works. The system can be used for accessing vehicle internal ECU parameters. It

controls/hack the vehicle from remote place. Connecting two or more nodes in the system does not cause any problem. The system works at a high speed up to 1Mbps.

[4] "Development and Designing of Automatic Wire Cutting System using Microcontroller".

The development of automatic wire cutting system will reduce human efforts required to cut the wire in proper length. The time required for cutting different length wires depends on efficiency of workers. Quality depends on accuracy and skill of workers. ARM 7 microcontrollers has been used to control the operation of the system. This system saves time required for cutting the wires. Workers cost is also saved.

[5] "Wire and cable routings and harness designing systems with AI, a Review":

Cable and wiring layout design is one of the complex and tiresome processes in building construction. Over the last few years, engineers have proposed several systems to design cable and wiring layouts. Few of these systems designed with the emerging technologies in Artificial Intelligence (AI). This paper reviews the recently proposed cable and wiring layout design systems designed with AI. The results of the analysis have shown the evolution of cable and wiring layout designing from manual trial and error method to intelligent simulation software has proved vast improvement to this field.

[6] "Robotized Assembly of a Wire Harness in Car Production Line".

This paper addresses an engineering attempt of utilizing multiple robot arms in assemblies of deformable parts. The developed robot system simulates a practically existing assembly process in an automobile plant where wrapped cables (wire harness) has to be fixed on the body of a car. This operation is performed by skilled workers and is considered to be difficult for automatization. The proposed methods in the paper are verified by a successful demonstration of wire harness assembly under a condition similar to a real plant.

[7] "Design of hardware Circuit of Wiring Harness Test Based on S3C44B0".

Embedded systems are used in industry control field widely for its excellent advantages of small space, powerful performance, high reliability, low power dissipation and special purpose. In this paper, we designed an embedded ARM hardware circuit using the microprocessor S3C44B0 as a core according to a testing principle of wiring harness. Its interface circuit can be used for controlling and data transmission, and the wiring harness testing circuit was implemented by CPLD.

[8] "Wiring harness design can a computer help?"

The paper explains a software based system that can be used for designing. One of the key features of the system is that it is used interactively. The choices and calculations can always be modified by the engineer in order to suit specific requirements. It is also easy to modify the design constraints and to analyze alternative design solutions.

[9] "Method and System for Multilateral Validation Of Wire Harness Design Outputs".

System and Method for multilateral Validation of Wire Harness Design Outputs wherein said method comprises of validating with respect to one another and with respect to component database, the background data files (BDF).

III. DESIGN

The harness design is easy and less complex using software. One of the software is Capital Harness.

Capital Harness[Ref: 13]:

Capital Harness XC enables harness engineers to create fully detailed, validated and manufacturing- ready harness designs rapidly and easily. Conceived from the ground up to be highly configurable, companies can tailor the tool to meet their precise needs, both in terms of graphical outputs and the way designs are created and validated. In addition, rules-based

Collaborative Design Merge functions provide automated integration of multi-source design inputs at a detailed level, simplifying the task, and raising the efficiency of collaborative design.

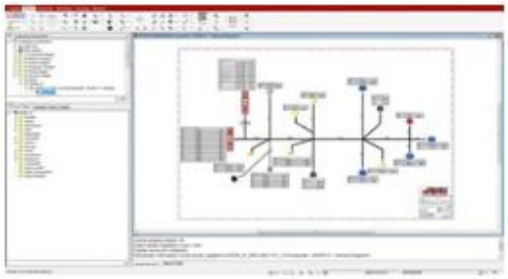

Figure 2.1 Capital Harness Software [Ref: 12]

It is an effective tool for the design and it also reduces the complexity of the design and time required to design. Error correction is also simple.

Added features and benefits:

1. Powerful graphical harness design environment

2. Automated harness engineering, validation and reporting
3. Collaborative Design Merge raises efficiency of multi-site, parallel design
4. Seamless integration with other Capital tools
5. Powerful data integration interfaces with major.

NX Editor[Ref: 13]:

The NX Editor is used to develop test programs for all NX Testers. The NX Editor uses no command language, but instead employs a powerful and easy to use flow charting tool for test program development. Describing the wire harness connections is done with simple entries in a connections table.

Test programs are transferred to the NX Tester using the NX Memory Card or by downloading via a serial port connection from the PC. Once the program is transferred to the NX Tester, it runs stand-alone with no need to maintain a PC connection. The NX Editor uses the actual attributes of the harness components (connector names, wire names, wire colors). This enables the NX Tester to display meaningful information when an error is encountered, allowing the operator to quickly and easily locate the problem.

There are various steps in configuring the Code for NX Editor

1. Fixture Block:

The fixture block in NX editor we have to write all the pins that are present in the harness and that are to be checked. The interfacing of jigs and Dynalab is done here. The interfaced pins that are connected are mentioned in this part.

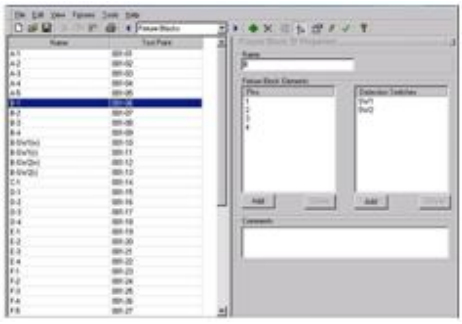

Figure 3.6 Fixture block in NX Editor [Ref: 13]

2. Connections:

Here, the connections are defined. This is only for continuity tests i.e. end to end connectivity. All the pins that should have a connection in the wire harness are mentioned here.

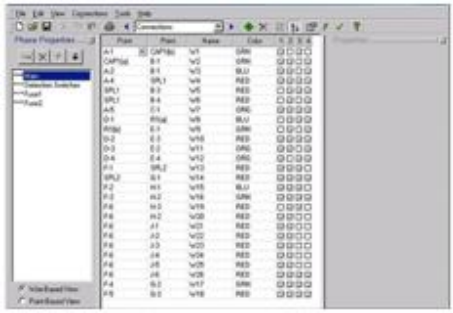

Figure 3.4 Connections in NX Editor [Ref: 13]

3. Work Flow:

This is the final step to complete the code for Dynalab tester to test the harness. The flow of testing is mentioned. If there are various sub parts in the harness that are to be checked in an order. The order is mentioned in the work flow, i.e. if there are some fuses in the harness, step 1 will be to check the continuity and step 2 will be to check the fuse. If step 1 is not successfully executed it won't go to step 2.

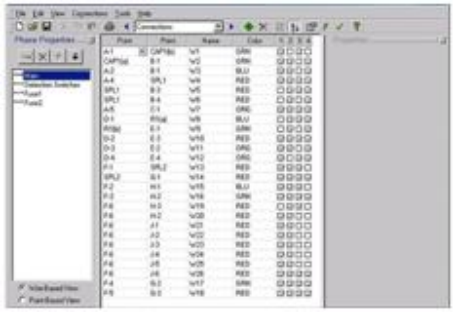

Figure 3.4 Workflow in NX Editor [Ref: 13]

Dynalab Tester [Ref: 10]:

Testing is an important aspect as it is very essential for a harness to function as desired. It should completely be error free. Dynalab tester is used for this purpose. It is a microcontroller based tester that checks the connectivity from point to point.

Figure 3.5 Dynalab Tester [Ref:10]

IV. CONCLUSION

There are various methods involved in designing in of wiring harness for automobiles. There are various automated techniques used in designing the harness which reduces the error.

Complexity of designing a harness can be reduced using software based system like Capital harness and NX Editor. This also reduces the chances of error.

The testing of the harness and error detection is simpler and error correction is easy.

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