Advanced Materials Research
ISSN: 1662-8985, Vol. 983, pp 404-407
doi:10.4028/www.scientific.net/AMR.983.404

Submitted: 2014-05-06
Accepted: 2014-05-06
Online: 2014-06-30

Design on the detection system of stud welding dynamic parameters

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Keywords: Stud welding; Dynamic parameters; Detection system.

Abstract: Stud welding plays an important role in fixing stud on car bodies. The quality of stud welding is seriously affect automotive security. During the stud welding process,stud welding machine by monitor welding current,welding voltage and welding time to determine the welding quality is good or bad,and uses the average parameter monitoring system,but there are many defects of welding quality relate to these instantaneous value of the parameter.Based on the above issues, designed a dynamic parameter detection system.through the real-time monitoring of dynamic parameter,it can more accurately detect the defects of welding quality.

Introduction

With the development of modern industry, especially in the automotive industry, the stud demand more and more. Stud welding as one of the main fixed form of stud, has been widely used. In the actual production, the stud welding shows its advantages. Its performance is reliable and easily to master. The development trend of stud welding is intelligent, high efficiency, stability, special and etc.With the progress of automation technology and the development of modern monitoring technology, when the stud welding going on the welding parameters can be observed directly. The parameters can be adjusted at any time to reduce the failure rate of the welding. Therefore, the information collection and analysis of welding parameters is very important.

In order to improve the precision of welding, stud welding machine is special development, the data shows that more than 80% of stud welding has the specialty welding machine for welding in the abroad. Through the use of stud welding, it can ensure the quality of the stud fixed and improve production efficiency at the same time.

Stud welding and the problems in the process of welding

Stud welding is a special method for stud welding.In the process of welding, first of all, through the low current to ignition the arc.And then through a large current, the nugget is big enough which contacted by the plate and the stud. At last, Exert enough pressure to the stud, which will fixed on the board[1].

In production, there is many factors influence the quality of welding. According to the characteristics of stud welding, the problem in the process of welding have proposed as the following.

Firstly, the output data of the machine is instability.

Secondly, the stub and the workpiece are not cleaning enough.

Finally, stud welding nucleation time is short and in a closed state so that it brings difficulty for the quality detection of the stud welding.

Through the real-time monitoring for the welding parameters in the process of transformation, to establish the curve of dynamic parameters and welding quality. It will more accurately judge for the welding quality

The Composition and the function of each part for the detection system

The detection system is mainly composed of hardware system and software system. The hardware system includes a current sensor, voltage detection system, data acquisition card, etc. The LHB - 800 Hoizer sensor is the current sensor which we used. The data acquisition card includes a control unit, ADC converter, transmission unit and storage unit. The data transfer and conversion is the main work for hardware system. The software system uses virtual instrument. It includes two parts, namely the hardware and the software. The main function of the hardware parts of the virtual instrument is to conversion, acquisition and transmission of signal. While function of the computer system is to analysis storage, display, processing of the data. The design of the software is the key part of the whole system. Methods is introduced by the LabVIEW software which is launched by the NI company. It uses the special G language programming.

The Design of the current sensor system. Fig.1 shows the principle of the Hall-effect. In the process of stud welding, in order to obtain enough nuclear heart to formation the nugget in a short period of time. Usually, uses the large electric current as high as 1500A and Low voltage as 5V. According to the Characteristics, uses the LHB Hoizer Current sensor and the JMD types of ac/dc to supply the power. Using the principle of Holzer effect[2].

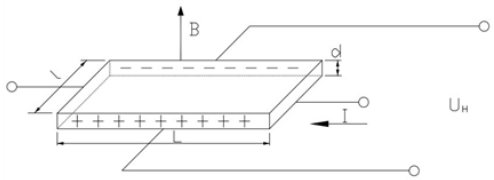

Fig.1 Hall-effect Diagram

Passing a current in the ends of the Hall-element. When the current passing, The induced magnetic field is produced. Use the B express the Magnetic field intensity. With the function of the Magnetic field, the Induction electromotive force will produce on the Holzer components. The output Electromotive force is showed as the following[3].

$$U_H = \frac{R_H IB}{d}$$

U_H—Induction electromotive force;R_H-hall constan（$m^3.C^{-1}$）;I-electric current（A);
B-magnetic field intensity（T）;d-Holzer element thickness（m).

The Design of the data acquisition card. The data acquisition is an essential part of the digital signal processing. It plays an important role for the whole system. The rapid development of the Computer technology. The connection of computer is used more standardization. While, the data acquisition card connected with the computer is more conform to the corresponding standard. Currently widely used bus standard is the PCI, SIA,USB and so on. It should be guarantee the stability of high-speed data acquisition and transmission in the process of stud welding dynamic data collection. So it choices the USB as the bus. Its characteristic is high acquisition speed, high transmission rate, feature-rich, Stable performance, low price,etc. Fig.3 shows the data acquisition card structure.

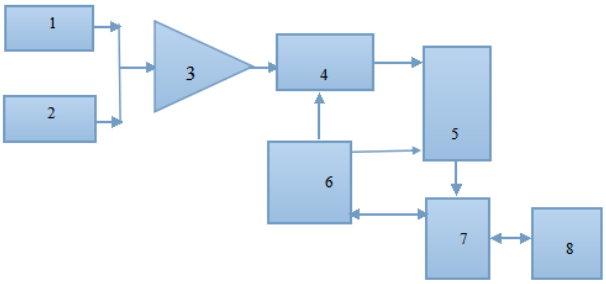

Fig.3 Date Acquisition Card Structure

1-sensor；2-voltage signal；3-amplifier；4-A/D conversion circuit；
5-memorizer；6-controller；7-USB interface；8-industrial computer.

The process of it works shown as the following. At first, the analog signal will be changed into a voltage range of ADC to accept through the probe and the amplifier. According to the fixed sampling and holding circuit sampling rate, the signal will be decomposed into independent level signal. And then, the A/D conversion circuit will changes the level signal into digital sampling point. The data is stored in the high speedcache. At last, through the USB interface, the data in the PC will be processing and analysis.

The design of the software. Fig.4 shows the data acquisition interface.

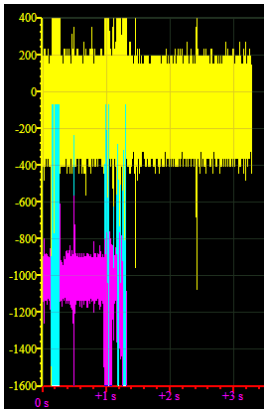

Fig.4 Date Acquisition Interface

Through the LabVIEW software the multi-channel parallel data acquisition system of information interaction can realize simple and quickly. It doesn't use the special data acquisition card by NI company, so the USB port should be modulated by the VISO bus I/O software[4]. The configuration of VISO bus step shows as the following.

Firstly, Drive Development Wizard to create INF file.

Secondly, Installation INF file, and Installation the USB equipment of the INF file.

Lastly, debugging the equipment by the NI-VISO, Monitoring of USB devices are installed correctly and abtain all kinds of attribute values of the USB.

The detection system is mainly monitoring the changing of current and voltage. In the program development, the detection system should call the AI config VI modular, AI start VI modular, AI read VI modular, AI clear VI modular in the function module to collect the data.The preparation steps are as the followsing[5].

Firstly,calling the AI config VI modular, configuration data acquisition card so that thethe cache configuration is twice of the sampling rate. Channel configuration set for both collection.

Secondly, calling the AI start VI modular to realize analog input operation. The main work is to realize the set of channel samples and data sampling rate.

Thirdly, calling the AI read V modular in the cycle of while. Using the cycle of while and the AI read VI modular reads the data from the cache cycle continuously. By setting the number of scanning to detect the number of readout. Set the trigger level(0.1V) by the Triggering setting in the modular. In order to accurately to the collected signals, after the signal to filter was calibrated and the waveform display and calculation of effectivevalue.

Lastly, calling the AI clear VImodular after the data acquisition. Stop collecting device for data and eliminate the simulation operation and buffer data configuration.

Conclusion

The detection system applied to the actual work. The Sampling rate and the depth of the storage can meet the needs of the monitoring. At the sanme time, it can be detected that there is a correspondence between the welding defects and parameters. It is suggests that the parameters could be monitor with the change of the current and voltage. Compared with the average parameters, it is easy to test out the stud which have the welding quality problems. It Improves the ability of remote monitoring of stud welding.

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Advanced Materials and Engineering
10.4028/www.scientific.net/AMR.983

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