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Wireless Digital Control and Synchronization of Master-Slave Multiple Motors Using ARM Microcontroller

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ABSTRACT
The co-ordination and synchronization control of motion of multiple motors is a challenging problem, since the synchronization of each individual motor can be influenced by many factors. This paper presents the concept and implementation of a scheme that uses a real time control approach to realize drive synchronization of the multiple motors. The basic principle of the control is the speed of both master and slave are measured and compared in such a way to get speed synchronization of both motors regardless of different modes of operation. A new Master-Slave configuration is developed. Imperfect synchronization can be corrected on-line using ARM This paper discusses an implementation where a continuously variable speed operation is provided for the multiple motors by using a single low cost ARM controller. These controllers implement variable speed drives with minimum external hardware thus increasing the reliability. A new master-slave control scheme using ARM is developed. Imprecise synchronization the master-slave technique is designed to reduce the synchronization error under the assumption the slaves can follow the master instantly. More recently there has been a large interest in electronic synchronization, because it offers certain advantages in terms of flexibility and reliability.
Keywords-ARM microcontroller, Master-Slave-motor, PWM, RF module, Synchronization,

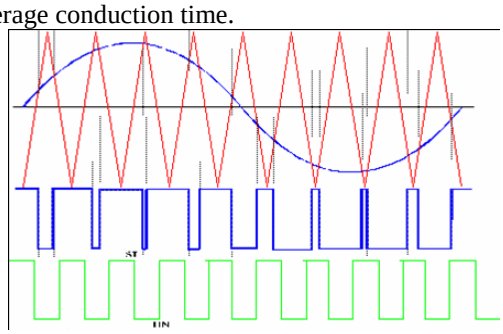
I. INTRODUCTION

In highly competitive market put pressure on manufacturing industry towards the improvement of machine flexibility and productivity. A typical traditional machine design with mechanisms (such as gears, camshafts, linkages) has a number of disadvantages : extended part changeover time, inaccuracies due to wear , rudimentary motion profiles and the reliability of mechanical transmissions tends to be reduced by increases in machine speeds. Industry has been attracted by the possible replacement of the traditional machine with the system multiple motors. The function that each drive performs is readily programmable. The drives are forced into coordination and synchronization by some sort of software mechanism which are also implemented by programming Many manufacturing process require that constituent parts of a mechanism be synchronized. These processes would include any based on the manufacture or handling of sheet materials such as project or rolled steel Traditionally processes would be synchronized through a mechanical transmission system consisting of a line-shaft, gearing, pullers, etc Among the available software mechanisms, master/slave synchronization is a widely used technique Some applications require the motion of the slave axes to follow the actual states of the master (such as in packaging, flying shears and other cyclic cutting applications), and this arrangement reduces the relative following-error more directly than some of alternative synchronization mechanisms More recently there has been a large interest in electronic synchronization, because it offers certain advantages in terms of flexibility and reliability. For example, where product specifications vary with the relative motion of constituent sections, this can be changed in software with a minimum of down time and possibly even online. The increases reliability has much to do with the removal of the mechanical transmission

II. Pulse Width Modulation (PWM) technique

There are many forms of modulation used for communicating information. When a high frequency signal has amplitude varied in response to a lower frequency signal we have AM (amplitude modulation). When the signal frequency is varied in response to the modulating signal we have FM (frequency modulation. These signals are used for radio modulation because the high frequency carrier signal is needs for efficient radiation of the signal. When communication by pulses was introduced, the amplitude, frequency and pulse width become possible modulation options. In many power electronic converters where the output voltage can be

one of two values the only option is modulation of average conduction time.



2.1PWM technique in multiple modes

Master Mode:

This mode is needed in order to ensure the synchronization. In this mode the system will only set the speed as the master motor and system will take this speed as input for the reference for slave system otherwise the user will need to set the individual speed separately for each slave motor even though the speed value is same for all.

Master – Slave Mode

In this mode the user will set the speed of master using admin controlled PC and the master will achieve the speed using closed loop system and RPM sensor the master will also send the current speed back to the Server PC. The master will then the send the speed to the slave system via wireless RF data transmission the salve will continuously track the master in order to check the speed changes And accordingly adjust its speed in this way the synchronization is archived

Motor Parameter Monitoring Mode

In this mode the master motor and slave motor will be observed by the sensor modules attached to the particular motors like over temperature, the master and slave both immediately inform this to the admin PC and error messages will displayed on it with respect to the master slave motors in this mode Rf will act as dual transmission mode

Individual Mode

In this mode the admin can use master and slave as individual entity and can set different speed for each of them.

III. RF module

RF modem can be used for applications that need two way wireless data transmission. It features high data rate and longer transmission distance. The communication protocol is self controlled and completely transparent to user interface. The module can be embedded to your current design so that wireless communication can be set up easily. RF data modem working at 2.4 Ghz frequency in half duplex mode with automatic switching of receive/transmit mode with LED indication. Receives and Transmits serial data of adjustable baud rate of 9600/4800/2400/19200 bps at 5V or 3V level for direct interfacing to microcontrollers. This model can work with other 2.4 Ghz Sunrom models 1197(30 meters range) or 1253(RS232) or 1252(USB).

IV. Advantages

Wireless speed synchronization is achieved Very useful for performance checking Automatic speed control saves the time can operate in multiple modes hence increase system efficiency

V. Application

Industrial machines
Production industries
Conveyer Systems
Performance Testing

VI. CONCLUSION

Multi-motor systems have been widely used in industrial applications, and speed synchronization of the motors can always be deteriorated by system parameter uncertainties. This paper discusses an implementation where a continuously variable speed operation is provided for the multiple motors by using a single low cost ARM controller. These controllers implement variable speed drives with minimum external hardware thus increasing the reliability using ARM is developed. The master-slave technique is designed to reduce the synchronization error

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