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Speed synchronisation of multimotor drive via profibus

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I. Abstract

Multi-motor systems has vast application industrial environment. Applications can be found in offset printing, paper machines, textiles industries and robotics also. Multi-motor techniques are required where synchronization speed during acceleration, deceleration and changes in load requires speed and angle synchronization between at least two axes. Several synchronization techniques have been developed in order to fulfill those necessities. Here the profibus Technique with common DC parallel grid is used so efficiency is high.

II. Key Words

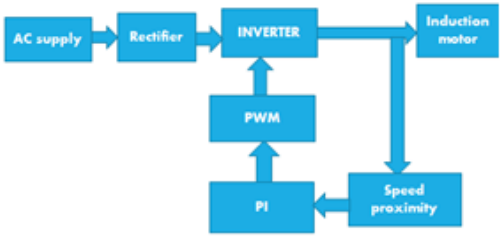
Mutimotor control, profibus communication, Sliding mode control (SMC), Synchronization

III. INTRODUCTION

With the development of electric driving systems, the synchronization running control of multi- motor system has been used widely in many industry fields. In order to improve the performances of dynamic and static, and meet the accurate control requirement of synchronize running to multi-motor system, the research on the synchronized control of multiple motors is getting more and more important. A successful synchronized control technique to multiple motors system must include both the control of speed and the control of torque. The result of research can be used for military affairs, aviation, and commonly industrial technology. It can offer coordination control technique to those congener control system, which also need synchronous drive for multiple motors. The real-time data communication is necessary for the synchronization control of multiple motors. In order to satisfy this requirement, the complex signal lines are usually used largely to measure the speed and current of each motor, or to transfer various control commands to the equipment. The traditional communication technique based on centralized control exist many problems which make

reliability fall and economy cost increase. This is because of large numbers of wiring, complexity of electric circuit, noise and maintenance problems, etc. In order to solve these problems, a simple synchronization control system with the aid of PROFIBUS-DP fieldbus communication mode is proposed in this paper. PROFIBUS fieldbus is used widely in many automated systems such as manufacturing industries and process factories. It is a kind of mature technique to realize network control for distributed control system from the scene to the workshop, or to further realize long-distance control of the equipments. In this case, some special wiring which is expensive is not necessary any longer. Furthermore, the system can be modified via network nodes without changing wiring. Development of micro-processers has brought significant changes in motion control technology. The development of high-speed control method sliding mode control (SMC) paves the way to software servo for motor control. High-speed SMC controller with processing higher speed initiates the age of digital motor and motion control. Digital PWM control of the power converters and digital current regulation of the motor drives enable the feasibility of developing universal motor drives using software control technique. Successful application of digital motor drives needs computer interface with higher transmission rate and high-level motion and motor control protocols.

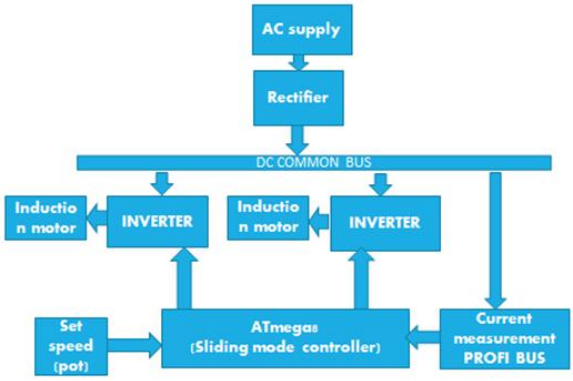
IV. Existing System



V. Disadvantages

Speed accuracy is low and speed oscillation is high in this existing method. Also this method gives slow response time.

VI. Proposed System



VII. Description

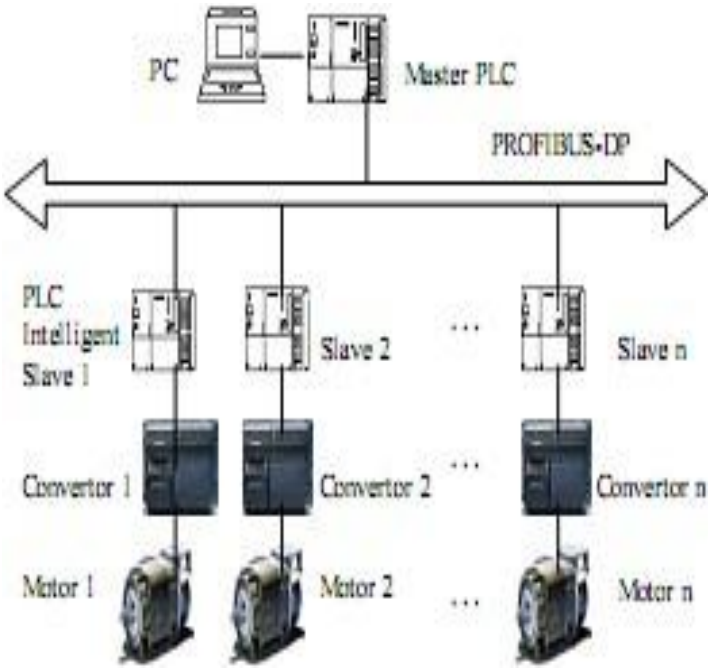
The proposed system will increase the productivity and reduce the power consumption. Speed set point is given to one motor following motors speed would be matched to same speed of the main motor. So that balanced tension is achieved to avoid papers getting damaged. The mode of communication is Profibus.

Speed table

SR. NO.	Set Speed (RPS)		Expected Speed (RPM)		Actual Speed (RPM)	
	(Slave 1)	(Slave 2)	(Slave1)	(Slave2)	(Slave1)	(Slave2)
1	37	40	2220	2400	2206	2410
2	38	42	2280	2520	2238	2642
3	40	37	2400	2220	2400	2224
4	42	38	2520	2280	2610	2247

waveform	signal transitions per period	harmonics eliminated	harmonics amplified	System Description	THD
	2	-	-	2-level square wave	~45% [3]
	4	3, 9, 27,...	-	3-level "modified square wave"	> 23.8% [3]
	8			5-level "modified square wave"	> 6.5% [3]
	10	3, 5, 9, 27	7, 11,...	2-level very slow PWM	
	12	3, 5, 9, 27	7, 11,...	3-level very slow PWM	

The structure of multi-motor control system based on profibus



Output waveforms

VIII. Advantages

By this method, we can control many motor at a time and so that the motor speed ripples is low and also the settling time for speed is low. Feedback response is very fast.

IX. Applications

Applications can be found in offset printing, paper machines, textiles industries and robotics also.,

X. Literature survey

A. Multi-motor synchronization techniques

Multi-motor applications has become very attractive field in industrial applications replacing the traditional mechanical coupling .Applications can be found in paper machines, offset printing, textiles, differential rives, to name some examples. Multi-motor techniques are used where matched speed during acceleration, deceleration and changes in load requires "truly" speed and angle synchronization

between at least two axes. Several synchronization techniques has been developed in order to fulfill those necessities, in this work the master-slave, cross coupling technique, bi-axial cross-coupled control method, electronic (virtual) line-shafting and the relative coupling strategy are compared for different industrial applications. Practical results in a two 1.5 kW induction machine test ring are presented, showing advantages and limitation of those techniques during Multi-motor applications has become very attractive field in industrial applications replacing the traditional mechanical coupling Applications can be found in paper machines, offset printing, textiles, differential rives, to name some examples. Multi-motor techniques are used where matched speed during acceleration, deceleration and changes in load requires "truly" speed and angle synchronization between at least two axes. Several synchronization techniques has been developed in order to fulfill those necessities, in this work the master-slave, cross coupling technique, bi-axial cross-coupled control method, electronic (virtual) line-shafting and the relative coupling strategy are compared for different industrial applications. Practical results in a two 1.5 kW induction machine test ring are presented, showing advantages and limitation of those techniques during different load conditions. The work reported in this paper makes use of a V/Hz motor control scheme, but conclusions drawn can be applied to any motor control technique. Parallel research is ongoing; results are reported on future publications.

B. The speed control of permanent magnet synchronous motor using fuzzy logic and self tuning fuzzy pi controller

This paper obtains a nonlinear mathematical model of Induction motor, and realizes simulation of obtained model in Mat lab/Simulink program. Speed control of motor model is made with Fuzzy Logic (FL) and Self Tuning FLPI (STFLPI) controllers. Controller performances are compared from the speed graphs obtained.

C.Speed control of induction motor drives by using neural network controller

This paper presents modeling, controller design and simulation of a Induction motor drive. The hysteresis current controller is used for inner loop current control and PI controller for outer loop speed control. In this paper the design of a Neural Network based approach is used to enhance efficiency in a vector control of Permanent Magnet synchronous Motors (Induction motor). The conventional Proportional-Integral (PI) controller is mainly used in industry because of the robustness this regulator acquires. But in some case, when the dynamics of the system changes over time or with operating conditions, the performance of the controller will be spoiled. The Artificial Neural Networks (ANN) used as a speed controller seems to be a promising solution in this purpose. In this study we apply a feed forward neural network in place of PI controllers of the vector control scheme of the

Induction motor. Analysis and simulation results are presented to demonstrate the validity of the proposed controller to ensure robustness against load and parameters variations and to achieve the required performances.

XI. Conclusion

Master-Slave configuration is the simplest topology but it is inherent lack of stiffness results in an appropriate technique for multi-motor synchronization. Cross coupling offers good speed synchronization and it can be easily implemented, but it haves a limited performance where a relative angle is a main. Relative coupling offers the best performance but the highest complexity, as well.

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