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Gliwice, 14.01.2011 r.

Streszczenie pracy doktorskiej pt.

**ZINTEGROWANY SYSTEM STEROWANIA
I DIAGNOSTYKI NAPĘDÓW ROZPROSZONYCH**

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THE INTEGRATED SYSTEM OF CONTROL AND DIAGNOSIS OF DISTRIBUTED DRIVES

ABSTRACT

Industrial control and diagnostic systems are described by several qualities: a control system organization (centralized or distributed), an application size, type of measuring equipment (sensors and actuators), a technical orientation, etc. In case of decentralized systems the main problem is connected with elaboration of the method that joins control and diagnostic functions on the basis of an accessible equipment of the concrete application.

A basic aim of described work is presentation of basic assumptions of The Integrated System of Control and Diagnosis of Distributed Drives. Development of the coherent project was performed as a result of an adaptation of the test stand, belongs to an equipment of The Workroom of Sensors and Industrial Networks of The Laboratory of Automation Mechatronics and CIM located in the Institute of Engineering Processes Automation and Integrated Manufacturing Systems.

At a base of the project applied a machine definition at the form of strictly connected functional subsystems as a conversion of an energy subsystem (mechanical, electrical, etc.), the structural components subsystem and the information subsystem.

A separation of particular blocks enables synthesis of the drives environment and definition of basic dependences between functional subsystems.

The work includes also analysis of the industrial distributed drives environment and basic information about the elaborated method of a diagnostic assessment of a condition of drives, control or supervisory devices.

Elaborated system includes two main elements. First part contains a hardware platform, contains PLC controllers, drives, frequency converters, HMI panel with installed visualization of the considered process and its states. The second element includes dedicated computer environment.

An integration of an automation system, allows machine states tracking, in two individual variants:

- an expert mode – dedicated software allows states tracking of frequency characteristics, a time course of vibrations (acquired directly from vibration sensors), assessment of current states of the PLC controller and implemented industrial networks,
- the operator mode – taking advantage of a HMI display screen, indicates simplified diagnosis results with service facilitate commands (codes of defined failures).

An approach of an emergency states presentation has been executed in two independent variants:

- alarms signaling, animations, etc. (taking advantage of visualization resources functions related to SCADA/HMI systems),
- the expert system with integrated relational databases (based on the logic calculation, recorded in the dedicated computer software).

A concept of The Integrated System of Control and Diagnosis of Distributed Drives connects different, complementary reciprocal diagnostic modules, allow verification:

- a correctness of the selection of drives operational parameters and power transmission transfer elements,

- states of electric and electronic subsystems pertain to actuators and control devices,
- a control algorithm syntax of distributed drives at stages of programming, activation and operation,
- operational parameters of the most unreliable elements of electric drives.

Proposed syntax of the control and diagnostic algorithm bases at authorship blocks, allow extension of applications spectrum to the all types of devices, equipped in the ProfiBus DP interface.

Elaborated Integrated System of Control and Diagnosis of Distributed Drives is characterized by the following functional features:

- a universality on the level of PLC diagnosis and additional modules (within the framework of accepted restrictions),
- configuration freedom of the control and diagnostic system (towards exploited SLAVE units),
- a user interface compatible with assumptions of SCADA systems,
- the integrated expert system, allows identification of failure source and instantaneous generation of actions set, enable restoring of correct operating conditions of diagnosed units (in accordance with accepted assumptions of the proactive maintenance model).

Presented methods of diagnosis are additional tools, allow efficient maintenance of distributed drives or units equipped in ProfiBus DP interfaces. Utilization of a hierarchical structure and a notation of reciprocal relations with the aid of the set theory guarantee faultless interpretation of co-operation character of particular elements of distributed system.

States diagnosis of distributed systems elements or their subsystems requires a detailed identification of subassemblies and reciprocal relations between considered elements.

An integration of control and diagnostic functions must perform the following elements:

- an elaboration of the specific approach, allows connection two enumerated functions at the stage of design of algorithms recorded in programmable logic controllers,
- utilization of logic units equipped with fast processors or possibilities of operational memory extension,
- suitable parameters configuration of utilized industrial networks.

Application of elaborated functions with proposed algorithm structure allows to:

- reduction of amount of time require to an elaboration of a complete control and diagnostic system,
- omission of a phase connected with copying of registers contents from a global memory to the buffering memory (a direct manipulation on buffer memory registers),
- realization of different configuration types:
 - with execution of functions connected with control tasks,
 - taking full advantage of diagnosis possibilities,
 - connecting enumerated functions in the one coherent system broaden of additional features of the expert system.

Practical applications of integrated systems of control and diagnosis, taking advantage of industrial networks, are possible in many cases, among other things:

- at a phase of automatization of machines and devices assigned to the group of mechanized units,
- in the configuration of single automated machines, require a superordinated control or worked in strictly dependent relations (machine production lines, work centers, conveyors systems, robotized centers, etc.),
- automated systems concentrated on a small area (considered eventually like single machines), with identified modification necessity of traditional cable connections at industrial networks,
- remote control systems (realized with the aid of Internet network viewer).