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MONITORING OF ELECTROMECHANICAL PROCESSES OF THE COLD ROLLING MILL TAKING INTO ACCOUNT THE VARIATION OF THE INERTIA MOMENT

МОНІТОРИНГ ЕЛЕКТРОМЕХАНІЧНИХ ПРОЦЕСІВ СТАНУ ХОЛОДНОЇ ПРОКАТКИ З УРАХУВАННЯМ ВАРІЮВАННЯ МОМЕНТА ІНЕРЦІЇ

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The automated system for monitoring electromechanical processes of rolling mills is a specific system, the quality of which depends on the

efficiency of technological processes and the quality of rolled products. Any malfunction of sensors or software can lead to emergency mode and downtime of the equipment. In today's conditions of continuous growth in the cost of energy resources, many previously created technologies are becoming unprofitable, which negatively affects the competitiveness of manufactured products. This is especially true for the most energy-consuming technologies that contain electric drives, the load parameters of which remain uncertain and change over time. The moment of inertia significantly affects the transient processes in the electric drive, it was found that with an increase in the rolling speed, the oscillation of the system increases, which is caused by the variation of the moment of inertia [1]. Therefore, taking into account the variation of the moment of inertia, which changes during the technological process, in the monitoring system of the electromechanical parameters of the cold rolling mill is an urgent task and has a practical interest.

The article [2] discusses the operational control methods of the technical condition of the thick sheet rolling mills equipment. In [3], a method for assessing the state of electric drives based on the construction of a neural network is given. These diagnostics [4] are designed to recognize process faults that cannot be easily detected by analyzing only individual signals, but instead analysis in a multidimensional data space must be involved. To increase the efficiency of the use of diagnostic equipment, it is most appropriate to use it for the analysis of various purposes equipment and the use of combined diagnostic methods [5].

During the control and research of the technological process, conclusions about the operating conditions of the equipment and the nature of the technological process are made on the basis of the analysis of the values obtained during the measurement of its parameters. Measurement usually means obtaining and displaying information about some coordinates of the technological process. To solve the problem of measuring electromechanical parameters in the conditions of metal rolling production of cold rolling mill No. 1 of Zaporizhstal OJSC, a diagnostic multi-channel complex was developed that receives information from speed, current, and voltage sensors [6]. The following coordinates are monitored for each of the four electric drives (unwinding mechanism, tension rollers, rolling cage, winding mechanism): motor voltage, excitation current, armature current, as well as cage speed, which is taken taking into account the calibration coefficient proportional to the tachogenerator voltage. But the information regarding the variation of the inertia moment value is not taken into account.

In the general case, the dynamic moment of the electric drive of the winding-unwinding mechanism of the rolling mill consists of several components: the component determined by the acceleration of the strip during winding, which is determined by the change in the radius of the roll of wound material and the component related to the change in the moment of inertia. The second component appears when winding the strip on high-speed rolling mills, while the first component significantly affects the accuracy of maintaining the tension of the strip, regardless of the winding speed [1].

The analysis of the control system when the moment of inertia of the electric drive changes is carried out in [7]. To reduce the sensitivity of the control system to changes in this parameter, it is suggested to use a special sensor that allows you to maintain the dynamic characteristics of the system with the help of a corrective circuit. The negative influence of variation of the moment of inertia and load on the dynamic characteristics of the control system has been proven [8]. If it is not possible to install a sensor, it is proposed to create a model to identify an unknown parameter [9, 10] or to determine it indirectly [11, 12].

In order to organize indirect measurements of the moment of inertia of the winding-unwinding electric drive, it is necessary to have information about the change in the radius of the roll. The current value of the roll radius depends on the radius of the drum, the thickness of the metal strip being rolled and the linear rolling speed.

In order to reduce the sensitivity of the control system to changes in this parameter, it is proposed to conduct indirect measurements of the inertia moment of the winding and unwinding mechanisms, which will allow maintaining the dynamic characteristics of the system with the help of a corrective circuit.

Therefore, monitoring of rolling equipment is carried out according to mechanical and electrical parameters, which in most cases are quite strongly interconnected with each other. Therefore, when developing monitoring and diagnostic systems, the main electromechanical parameters should include rolling force, motor current and voltage, motor shaft rotation frequency, and load moment. To obtain information about parameters that cannot be measured, namely, the moment of inertia, their identification through mathematical modeling or indirect measurements is used. Taking into account the received measurement information about the variation of the inertia moment in the monitoring system of rolling equipment electromechanical processes will increase the efficiency of automatic control systems and reduce the possibility of emergency situations in rolling production.

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METHODICAL PROVISIONS OF MULTIFACTORIAL MODELING OF FORECASTING OF DEMAND FOR ELECTRICITY IN INDUSTRY

МЕТОДИЧНІ ПОЛОЖЕННЯ БАГАТОФАКТОРНОГО МОДЕЛЮВАННЯ ПРОГНОЗУВАННЯ ПОПИТУ НА ЕЛЕКТРОЕНЕРГІЮ В ПРОМИСЛОВОСТІ

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Регресійний аналіз зазвичай проводиться для об’єктів, що мають складну, багатофакторну природу. Прогнози, зроблені методом авторегресії, вважаються одними з найбільш точних статистичних прогнозів, саме тому вони знайшли широке поширення. Це пояснюється тим, що моделлю авторегресії чудово описується велика кількість самих різних економічних показників. Основна ідея методу полягає в побудові за допомогою регресійного аналізу моделі. Перевагою авторегресійного аналізу є отримання високоякісної (вірогідної) моделі з адекватним прогнозом при мінімумі витрат часу і вимог до вихідних даних. Недоліками такої моделі планування попиту на електроенергію є прогноз за вихідними даними можливий тільки на один період вперед.