The use of chemical system as transmission medium in wireless data communication channel

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ЛОМОНОСОВСКИЕ ЧТЕНИЯ НА АЛТАЕ: ФУНДАМЕНТАЛЬНЫЕ ПРОБЛЕМЫ НАУКИ И ТЕХНИКИ Барнаул, 13-16 ноября 2018 г.

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Abstract

Method of use of chemical system as transmission medium in wireless data communication channel (DCC) is represented in this article

1. Introduction.

The term "chemical system" was stated in [1]. A set of objects selected form the space forms system. If in this system the mass transfer processes and the heat exchange processes between all parts of this system are possible then this system is called thermodynamic system. Moreover, if in this system chemical reactions are possible then this system is called chemical system. Therefore chemical system is a particular case of thermodynamic system.

The term “intrinsic property of a system” is formulated in [1]. The state of the system is determined by system's properties. There is intrinsic property of a system (such as temperature, pressure, concentration) by which each point of the system is characterized.

The definition of intrinsic parameter of a system and examples of intrinsic parameters of a system are formulated in [2]. Variables that determine thermodynamic state of the system are called parameters of state. The parameters of a system that are aligned by contacts of different parts of the system are called intrinsic parameters of a system. Intrinsic parameters of a system are partial molar values, etc. For example, pH parameter is used to determine the acidity of an aqueous solution, and therefore pH parameter is the intrinsic parameter of an aqueous solution.

In [3] it was stated that the intrinsic properties of the system such as partial molar values as well as all intrinsic properties of the system are determined by pressure, temperature and the system's chemical composition.

A substance located in the chemical system is represented by the substance's chemical composition. Therefore the intrinsic properties of a substance depend on the substance's chemical composition. If the chemical composition of the substance is changed then some intrinsic properties of the substance are changing also. Thus a parameter of the chemical composition of the substance is a variable that represents a specific property of this substance.

2. Wireless data communication channel in chemical system.

New type of wireless computer network in a chemical system was invented in April 2015 [4]. In this wireless computer network data transmission “is achieved due to a method of organizing a wireless computer network in a chemical system, in which the transmission of electronic messages from one node to another node of this computer network is performed over a wireless link

created in a chemical system, which is set up by connecting to a source computer a system for supplying substances to the chemical system through operation of the system for supplying substances to the chemical system in accordance with the final sequence of parameters of operating modes received from the source computer and by connecting to a recipient computer a device intended for determining and recording parameters of the chemical composition of the substance, through which the recipient computer receives the results of recording the parameters of the chemical composition of the substance and restores the electronic message based on the obtained results of recording the parameters of the chemical composition of the substance" [4].

The nodes of this network are computers with connected chemical feed systems set up to feed substances into the chemical system and in-line chemical analyzers set up to conduct the chemical analysis of the substance located in the chemical system and register the results of chemical analysis of the substance located in the chemical system. Each chemical feed system is set up to feed certain substances in defined quantities and with defined state parameters of these substances, into the chemical system, through the implementation of its work in accordance with the set of parameters of its operating modes. Each computer confers the ability to control the operations of the connected chemical feed system via the transmission of parameters of its operating modes to this chemical feed system. Each in-line chemical analyzer is set up to conduct the chemical analysis of the substance located in the chemical system and register the results of chemical analysis of the substance located in the chemical system, and transfer the results of chemical analysis of the substance located in the chemical system to the connected computer. The transmission of electronic messages from one node to another node of this wireless computer network in chemical system is produced over the wireless communication channels, designed for the transmission of electronic messages from the source computer to the receiving computer.

Each wireless communication channel of this computer network is organized in such a way that a chemical feed system is connected to the source computer, and the chemical feed system is set up to receive mode parameters of its work from the source computer and implement the work of the chemical feed system in accordance with the received parameters of its modes of operation. The in-line chemical analyzer is connected to the receiving computer, and the in-line chemical analyzer is set up for the registration of the results of chemical analysis of the substance located in the chemical system, and transfer the results of chemical analysis of the substance located in the chemical system to the connected computer.

At first, an electronic message, which is transmitted, is encoded with the help of special programs in the form of a finite sequence of symbols, using a code satisfying the unique decoding condition. The obtained sequence of symbols is encoded with the help of special programs in the form of a finite sequence of chemical feed system operating modes using a code satisfying the unique decoding condition. Then, the finite sequence of chemical feed system operating modes is transmitted from the source computer to the chemical feed system connected to the source computer. Then, the substances are fed into the chemical system through the implementation of work of chemical feed system in accordance with the finite sequence of the chemical feed system operating modes.

To obtain an electronic message transmitted, an in-line chemical analyzer is connected to the receiving computer. This in-line chemical analyzer is designed and set up to conduct the chemical analysis of the substance located in the chemical system and register the results of chemical analysis of the substance located in the chemical system.

Then, the in-line chemical analyzer connected to the receiving computer, is set up for the implementation of the chemical analysis of the substance located in the chemical system and registration of the results of chemical analysis of the substance located in the chemical system, and the implementation of the chemical analysis of the substance located in the chemical system and registration of the results of chemical analysis of the substance located in the chemical system are carried out. Then the receiving computer with the help of special programs is set up to the mode of acquisition, trough the in-line chemical analyzer, the results of registration of the results of chemical analysis of the substance located in the chemical system. On the receiving computer, the results of

registration of the results of chemical analysis of the substance located in the chemical system are received. From the results of registration of the results of chemical analysis of the substance located in the chemical system, with the help of special programs, the finite sequence of chemical feed system operating modes is obtained. The obtained finite sequence of chemical feed system operating modes is decoded to obtain a finite sequence of symbols. Then the resulting finite sequence of symbols is decoded. As a result of this decoding, the transmitted electronic message is obtained. Very often the transmitted electronic message differs from the received electronic message due to a noise in the data communication channel (DCC). This is very common for data transmission and there are standard methods of data recovery with using, for example, noise-immunity coding. Therefore, additionally the noise-immunity coding (for example, Hamming code) is used in order to implement recovery of electronic messages transmitted through the proposed wireless communication channel in chemical system.

In [5] it was stated that the signals representing electronic message transmitted through the wireless communication channel of this wireless computer network in chemical system are changes of the intrinsic properties of a chemical system. These signals are created by feeding the substances into the chemical system through the implementation of work of chemical feed system. Therefore, the receiving of the electronic message is provided by the fact that after feeding the substances into the chemical system, the intrinsic properties of this system are changing due to the new chemical composition of this chemical system, and become aligned for each amount of material in this system.

3. Conclusion.

Thus the proposed wireless communication channel differs substantially from all bio-inspired communication channels for molecular communications (where information is transmitted by information molecules that are emitted by transmitter into the environment in which the information molecules propagate). Moreover, the principles of the represented wireless computer network in a chemical system also differ substantially from the principles of so called the body's chemical communication network which is called the endocrine system (where signals are transmitted through chemical messages called hormones). The proposed wireless technology as well as another wireless technology [6] invented lately require the development of new industry standards in order to use it not only in chemical industry but also for medical purposes, and as a new type of wireless body area computer network.

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