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EFFECTIVE APPROACH TO THE SELECTION OF MAINS RADIO FREQUENCY INTERFERENCE FILTERS

Introduction

Expanding the area of application of the functionality of radio electronic equipment (REE) for various purposes with increasing its sensitivity, demonstrates necessity for increased attention to the issues of ensuring electromagnetic compatibility (EMC) REE with other devices and the electrical network.

The permissible levels of radiated and generated interference are regulated by many standards. Regional regulatory documents in the field of electromagnetic compatibility is a set of standards prescribed by the 3rd version, the so-called EMC Directive of the European Parliament [1] there are other standards.

Due to the active growth and improvement of the Ukrainian railway fleet it becomes more difficult to comply with the requirements for electromagnetic compatibility (EMC).

Modernity requires new requirements for rolling stock equipment, a significant increase in the number of electronic equipment. The rolling stock is equipped with wireless Wi-Fi transceivers, a large number of computer equipment. Improved requirements for the quality of voltage 220 V (230 V), modern passengers use a network for the supply of high-tech equipment.

Interferences spreads along the wires and in the surrounding space. The norms and methods for EMC in electronic devices of Ukrzaliznytsya are described in detail in [2]. Concerning the urgency of the need to study the issues associated with electromagnetic interference in power circles in rail transport is evidenced by work [3, 8].

Effective means of providing EMC in conductive circuits filters [4]. Mains RFI Filters are produce a lot of firms: for example: Shaffner, Tusonix, Murata Electronic, Epcos, Corcom, Panasonic Industrial Devices, TDK etc.

One of the attempts to propose a acceptable method for selecting Mains RFI Filters from the database is taken in [5].

Reducing interferences that spread through wires is possible only with the use of RFI filters. However, an efficient choice of RFI filters among a large number of samples is not an easy task.

Purpose

The paper proposes a method for selecting a filter based on a database (DB) with information about the filters of leading companies.

The tendencies of further improvement of the set of software are shown.

Requirements for the algorithm

Modern equipment, especially telecommunication (it's hard to imagine a person without a smartphone, and it is a complex telecommunication device that simultaneously uses several frequency bands and several standards, Wi-Fi, Bluetooth, GSM, LTE)) has a greater sensitivity, which leads to a further increase in the relevance of the requirements for the electromagnetic compatibility of technical means. Despite the strict regulatory international, regional and national standards for the levels of emissions in wired circuits and the environment, observance in some real situations does

not provide protection of functional equipment from the effects of electromagnetic interference.

The modular principle of technology and systems enables the designer to use ready-made filters, guided by the level of noise and the sensitivity of equipment, measured by standardized means. Design and production of Mains RFI Filters is an area of the world's leading companies, supplying tens of thousands of filter types to the world market. Developers, when choosing, must take into account the features of the type of noise that must be reduced.

To the choice of the Mains RFI Filter is carried out by selecting the filter from the database, the characteristic of the attenuation which provides a reduction in the level of noise.

During the analysis, the frequencies at which the level of the resulting interference exceeds the permissible standards for the relevant electronic equipment in the path of propagation are taken into account.

Features of the algorithm and the program

The basis of the proposed algorithm is a modular approach, which makes it possible to effectively use previous developments.

The program enables to keep a database of filters. For each Mains RFI Filter, a parameter map is provided, namely: the name of the manufacturer, the filter type (s), the current strength for which the filter is calculated, the operating voltage, and the attenuations on the standard frequencies (discrete frequency response). The program allows to search in the database of filters according to the main working parameters.

The program searches and publishes a list of filters with characteristics that fit the filtering criteria. The database allows you to visualize and print all the characteristics of the selected Mains RFI Filters, with the frequency response can be given both in numerical form and in graphical representation.

The algorithm of the program is presented in fig. 1.

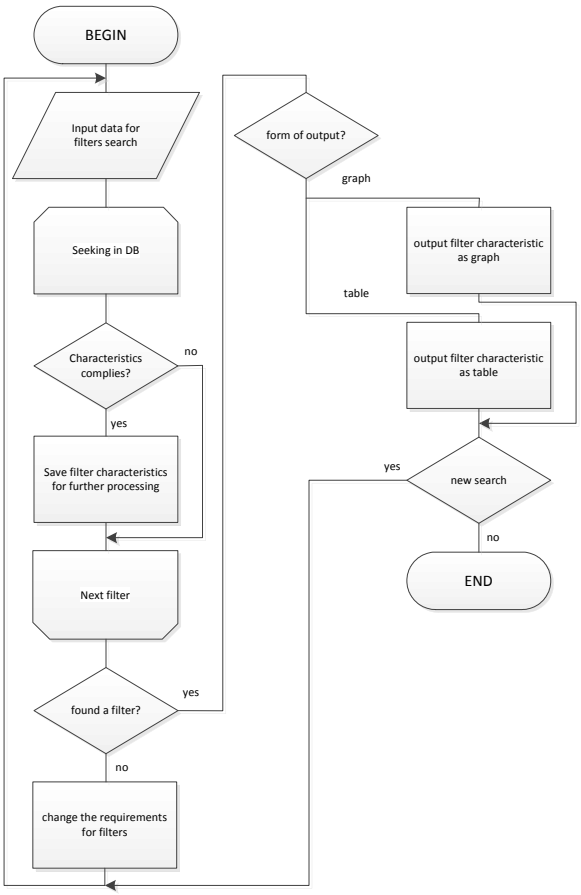

Fig.1. Block diagram of the algorithm for analyzing the level of conductive interference

Program description

The program is developed using web technologies in the PHP programming language [6]. It consists of a software core written in PHP and a database with Mains RFI Filters, which runs on a free MySQL 5.x database server [7].

The program interface is a window (page) with fields for entering filter search parameters. The source code of the developed program is contained in the following files:

style.css – webpage style module

add.php – adding to DB module

config.php – configuration module

delete.php – deleting Mains RFI Filters from DB module

filter.php – filters characteristics output module

header.php – webpage head module

index.php – main webpage module

update.php – DB update module.

The choice of Mains RFI Filter is made from the information entered in the database of contraband filters. All filters, whose frequency range corresponds to the entered data, taking into account the given deviation is taken into account.

The block diagram of the database is shown in fig. 2.

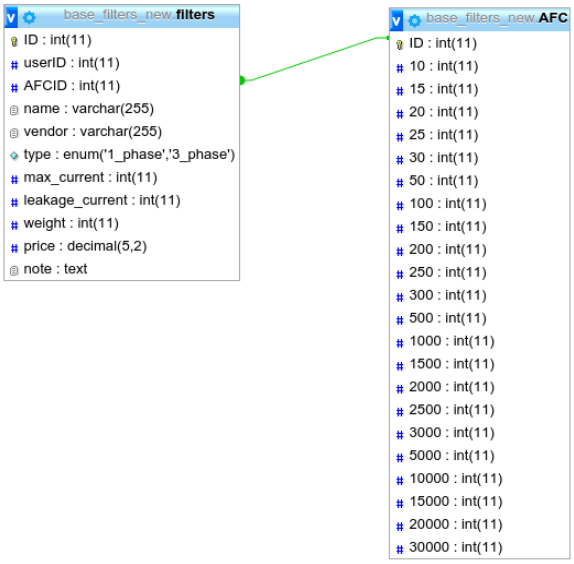

Fig. 2. Structure diagram of the database

The figure shows that the database consists of 2 tables The ***filter*** table contains information about the main filter options. ***name*** – filter name, ***vendor*** – manufacturer of filter, ***type*** – one, or three-phase filter, ***max_current*** – maximum operating current, ***leakage_current*** – filter flow current, ***weight*** – price, ***price*** – indicative price of filter; The ***AFC*** table is linked to the filter table and contains information about insertion loss at standard frequencies.

In fig. 3 shows the window of the program and marked the elements of the user interface.

After the search, the list of found filters corresponding to the input criteria is displayed. The search results window is shown in fig. 4.

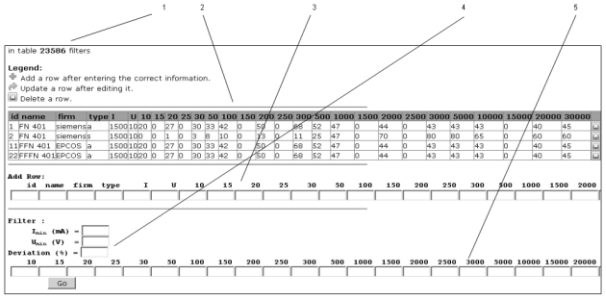

Fig. 3. Program main page:
1 - the number of filters in the database;
2 - zone of output characteristics of all filters existing in the database; 3 - fields for entering a new filter in the database; 4 - Fields for setting filters search parameters;
5 - Fields for setting frequency filter coefficients.

Fig. 4. Window with the results of selection:
1 - given characteristics of the filter; 2 - frequency characteristic of the filter on which the cursor is located

Scientific novelty and practical value

An improved algorithm for selecting Mains RFI Filters is developed, which is an effective means of facilitating the work of developers and users of the electronic broad-spectrum and special-purpose equipment.

Conclusions

The offered algorithm and the developed program provide improvement of process of designing of Mains RFI Filters on the basis of their nomenclature. This approach accelerates the development of technical tools that meet the requirements of EMC.

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Ключові слова: мережевий протизавадний фільтр, база даних, електромагнітна сумісність, завада, алгоритм вибору фільтра.

Ключевые слова: сетевой помехоподавляющий фильтр, база данных, электромагнитная совместимость, помеха, алгоритм выбора фильтра.

Keywords: Mains RFI Filters, data base, electromagnetic compatibility, interference, filter selection algorithm.

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