Monitoring Software Design of Passive Dynamic Filter

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Abstract. The objective of this work is to design the passive dynamic filter monitoring software. Recently, more and more non-linear loads are connected to the power grid, the distortion of the voltage or current waveform is caused by the serious harmonic pollution. The power harmonic not only does harm to the power electronic devices but also increases the power loss. Therefore, the passive dynamic filter has been developed by the author. Based on the hardware structure of the passive dynamic filter, the monitoring software of the passive dynamic filter is designed. The following works have been done in the study: control requirements of the monitoring system, component diagram of the passive dynamic filter monitoring software, program design of the monitoring software. This monitoring software has been used in the DCS of the passive dynamic filter.

Introduction

In recent years, with the development of electronic technology and the expansion of the industrial application, more and more non-linear loads are connected to the power grid. The content of harmonic is increasing and the power quality has fallen dramatically. In public power system, the harmonic can cause the overheating of electrical devices, the increase of power lose, and affects their operations.

To eliminate the harmonic in the power grid, the passive dynamic filter has been developed by authors [1]. Compared to the active power filter, passive dynamic filters have a lot of advantages, such as simple structure, low investment of equipment, higher reliability, easily maintain and widely used [2]. This filter is mainly consisted of variable reactor (KL), IGBT of trigger circuit and filter capacitor [3][4]. According to the control requirements of the passive dynamic filter, the passive dynamic filter monitoring software (PDFMS for short) is designed by the author. The following works have been done in the study: control requirements of the monitoring system, component diagram of the MSPDF, program design of the monitoring software.

Control Requirements of Monitoring System

The passive dynamic filter monitoring software is designed by the modularized programming design method. The DCS of the passive dynamic filter (DCSPDF for short) is designed [1]. Its structure diagram is shown in Fig.1.

The DCSPDF includes smart sensor 1~n, intelligent module 1~n, main controller, host computer, analog quantity outputs 1~n, digital output 1~n, passive dynamic filter 1~n and so on. The smart sensors are connected to the main controller by RS485. The working principles of the DCSPDF are given in [1].

Based on the working principle, basic structure and working characteristic of the passive dynamic filter, the control requirements of monitoring system are as follows:

Running on/off of the DCSPDF. Running on-off control of the DCSPDF mainly includes running on-off of the passive dynamic filter 1~n and the main controller. When the passive dynamic filter generates an error signal, the DCSPDF stop working.

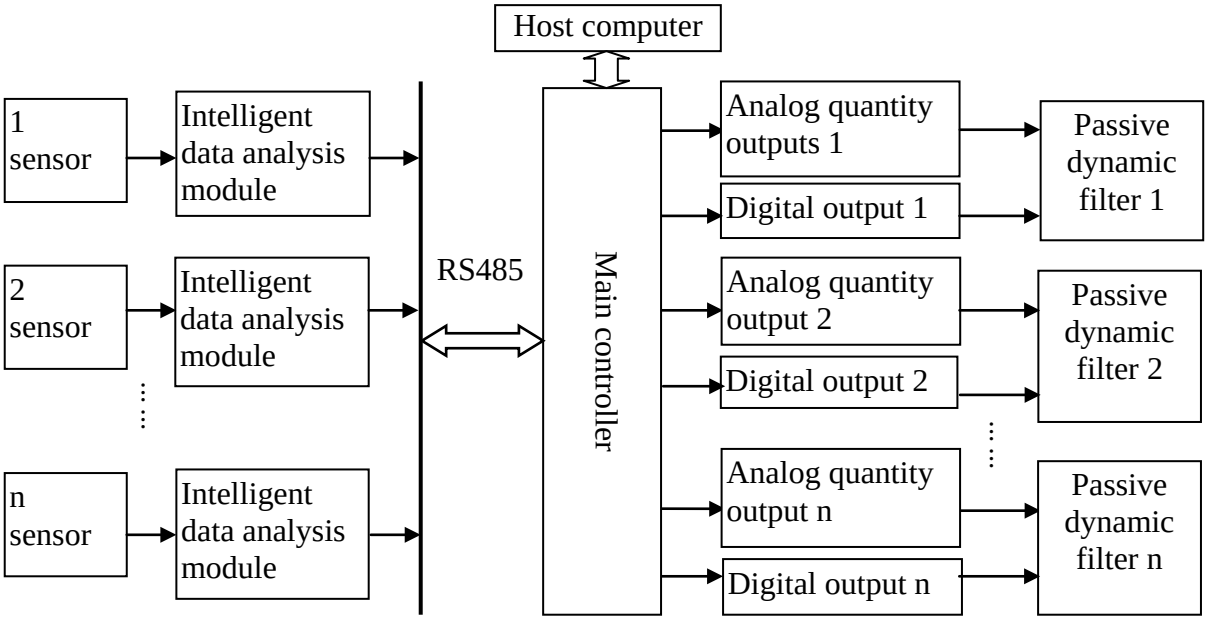

Fig.1. DCS of the passive dynamic filter

Filtering the specific harmonic. A specific harmonic, such as 5th harmonic, is selected in the monitoring interface. The PDFMS generates a signal and sends it to the main controller. The compensation capacitance is calculated by the control algorithm. And then the main controller switches on the appropriate passive dynamic filters.

Monitoring the current and voltage. The values and real-time graphs of three-phase voltage and current are displayed to ensure the stability and safety of the DCSPDF.

Fault monitoring. The faults in the DCSPDF are detected by the PDFMS. It ensures the safety of the DCSPDF and workers.

Component Diagram of the Passive Dynamic Filter Monitoring Software

The PDFMS mainly consists of the program of sending and receiving data, program of passive dynamic filters monitoring, program of data displaying, program of parameters setting, program of fault analysis, program of real-time monitoring and database. Its structure is shown in Fig.2.

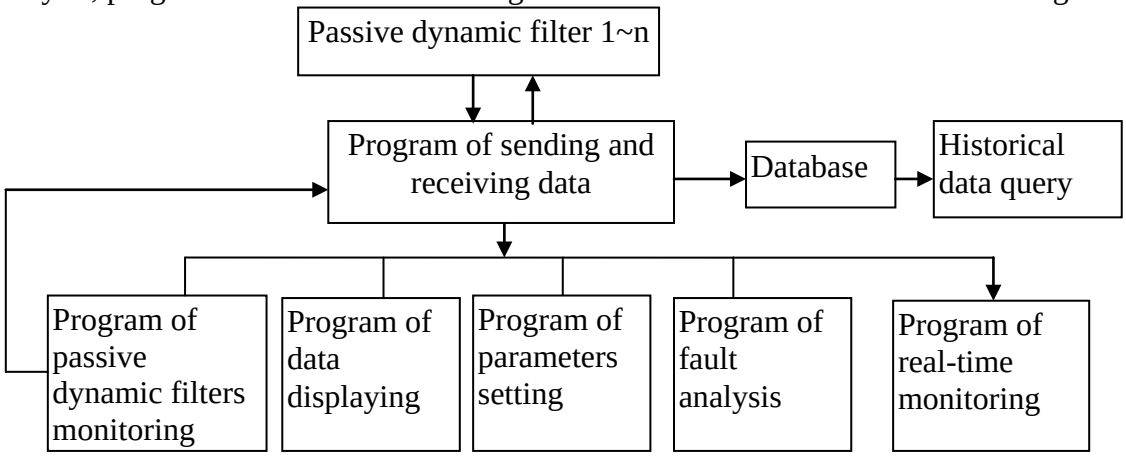

Fig.2. Component of the PDFMS

The data of harmonics are collected by the program of sending and receiving data. The data are stored in the database. Also these data are called by the subprograms. Database systems have wide application prospects in the distributed control system. Its high throughput, high reliability, standard interfaces and rich application software make the database achieve obvious advantages in the distributed control system [5]. The database is designed by SQL.

Program Design of the Passive Dynamic Filter Monitoring Software

According to the component diagram of the PDFMS, it is divided into five parts: the main program of the PDFMS, the program of data displaying, the program of parameters setting, the program of real-time monitoring and the program of faults analysis.

The main program of the PDFMS. The work status of each passive dynamic filter is displayed in the main program of the PDFMS. Clicking a button, such as filter 1#, the interface of real-time monitoring is displayed. The main program of the PDFMS is shown in Fig.3.

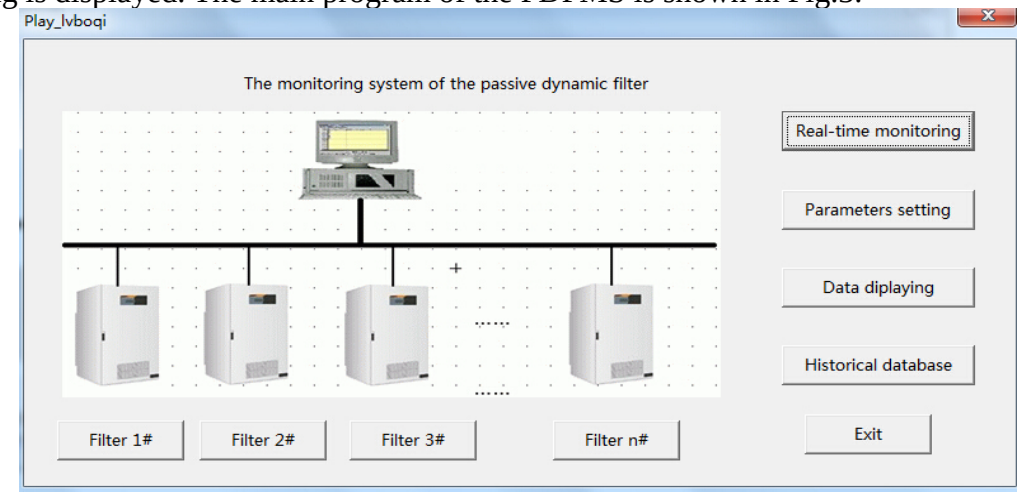

Fig.3. Main program of the PDFMS

The program of data displaying. The values of the harmonic current and voltage are displayed in the program of data displaying. These data provide reference for operations personnel to control the capacitance of the passive dynamic filter.

The program of parameters setting. The program of parameters setting is divided into two parts: manual control and automatic control. In the part of manual control, operations personnel set all parameters by hands. In the part of automatic control, parameters are set automatically by the PDFMS. Firstly, the values of harmonic current and harmonic voltage we set are compared with the feedback value. Then the PDFMS translates the value into an appropriate parameter by the control algorithm.

The program of real-time monitoring. The data of harmonic are displayed as graphs in the program of real-time monitoring. Operations personnel get to know the work status of the passive dynamic filter intuitive by graphs. And it is easy for them to control the CSPDF through the PDFMS. There are many buttons under the graph of three-phase power voltage. Pressing one button, real-time monitoring program of the single passive dynamic filter is displayed.

The program of fault analysis. When the value of harmonic current exceeds a threshold size, a warning page is displayed in the main program. The warning page shows what is wrong and which filter is wrong. Then problems are solved easily by operations personnel. A fault happens on the passive dynamic filter, such as filter 1#. Then a warning page is displayed in the main program and the button of filter 1# turns red. Then the CSPDF stops working.

Conclusion

A large amount of non-liner loads have been connected to the power grid, the power harmonic is increasing and the quality of electrical energy has fallen dramatically. The power harmonic need to be filtered, otherwise great power loss can be caused by harmonic. Therefore, a system of passive dynamic filter has been advocated.

The system can be realized functions, such as monitoring the status of passive dynamic filter, modify parameters, fault alarming and so on. The following works have been done in the study: control requirements of the monitoring system, structure of the MSPDF, program of the monitoring

system. This MSPDF has been used in the passive dynamic filter.

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