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Voor: METHOD AND SYSTEM FOR HIERARCHICALLY CONTROLLING CASCADED STATCOM SYSTEM

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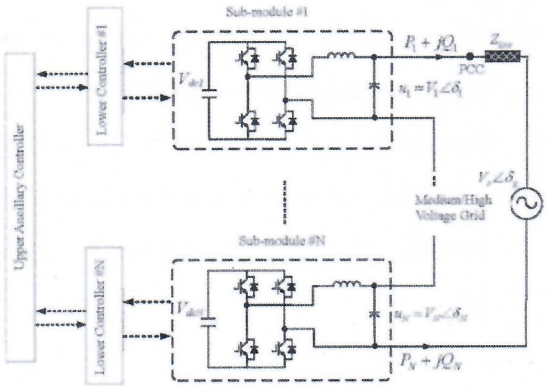
(54) **METHOD AND SYSTEM FOR HIERARCHICALLY CONTROLLING CASCADED STATCOM SYSTEM**

(57) The present disclosure provides a method for hierarchically controlling a cascaded STATCOM system, comprising steps of: generating an initialization parameter set in an upper controller; transmitting the initialization parameter set to multiple lower controllers, wherein each lower controller is configured to connect with and control a sub-module of the system; generating a PWM initialization modulation signal based on the initialization parameter set, and sending the signal to each sub-module so as to start up the system, and gathering voltage and current output from each sub-module after started; obtaining a PWM real-time modulation signal based on calculation on values of the voltage and current gathered, and controlling a voltage output from the sub-module; automatically detaching a connection of a sub-module with the system once detecting abnormal voltage or current, and reporting a message of failure; and receiving the message of failure, regenerating an initialization parameter set and transmitting it to each lower controller so as to reallocate the voltage output from each of remaining sub-modules.



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METHOD AND SYSTEM FOR HIERARCHICALLY CONTROLLING CASCADED STATCOM SYSTEM

Technical Field

The present disclosure relates to power electronic control system, particularly to a method and a system for hierarchically controlling a cascaded STATCOM system.

Technical Background

Static Synchronous Compensator, referred to as STATCOM hereinafter, is a typical inverter composed by power electronics, with no DC power source placed in the DC side of the front end, and outputs DC voltage merely by means of DC capacitor. STATCOM is generally applied in reactive power compensation for the power system so as to maintain the voltage stability thereof. In Medium/High voltage power system, in view of the limited capability of single power electronic device for withstanding over voltage and over current, the modular multi-level technique is generally adopted. Switching stresses occurred in single electronics device can be lowered through cascading modules of inverter. Compared with the typical neutral point clamped multi-level converter, the cascaded STATCOM system has advantages of independent sub-module, being easily extended, and simple structure etc., and thus is widely applied in the field of the Medium/High voltage power system for reactive compensation.

For the cascaded STATCOM system of the Medium/High voltage power system, it is essential to implement cooperative controlling among the submodules. With respect to the existing study, all the control goals are fulfilled in the centralized structure. In this case, a centralized controller is needed to gather global information such as signals of output voltage and current, voltage across the capacitor placed in the DC side of all modules, and voltage across the grid side, and process and provide given reference signals, so as to implement balanced voltage across the capacitors of all the modules, balanced reactive compensation between the modules, and

synchronized frequency with the grid voltage. Since the signals transmitted therefro are alternative and periodical, it is necessary to adopt high band-width communicatio during signal transmission.

In addition, since the global information for being gathered is considerabl enormous, especially in the case of a large number of cascaded modules of extrem high-voltage power system, the centralized controller with powerful processin capability is needed. In the meantime, one single centralized controller manages a the modules, and thus packet loss or delay taking place in one single module wi easily incur communication failure of the whole cascaded STATCOM syste Therefore, the reliability of the whole system will be significantly influenced due t the failure in the single module.

To overcome the above drawbacks, such as lowering requirements fo communication bandwidth of cascaded STATCOM system and processing capabilit of the central controller, and enhancing communication reliability of the whole syste a novel control structure is needed, so that the application scale of the cascade STATCOM system is expanded and thus the application cost can be further reduced.

Summary of the Invention

To solve the above technical problems, the present disclosure provides a meth for hierarchically controlling a cascaded STATCOM system, comprising steps of:

generating an initialization parameter set in one upper controller for starting u the cascaded STATCOM system;

transmitting, by the upper controller, the initialization parameter set to multip lower controllers via communication link, with each lower controller controlling ea sub-module of the cascaded STATCOM system, wherein each lower controller configured to connect with and control a corresponding one of sub-modules of th cascaded STATCOM;

generating, in each lower controller, a PWM initialization modulation sign based on the initialization parameter set received, and sending the PWM initializati modulation signal as a command to each sub-module in real time so as to start up th cascaded STATCOM system, and in the meantime gathering voltage and curre

output from each sub-module after started;

obtaining, in each lower controller, a PWM real-time modulation signal in each lower controller based on further calculation on values of the voltage and current gathered in real time, and controlling a voltage output from the module correspondingly connected thereto by the PWM real-time modulation signal;

automatically detaching a connection of one of the sub-modules with the system, once detecting abnormal voltage or current in said one of sub-modules by the lower controller, and reporting a message of failure to the upper controller; and

receiving, by the upper controller, the message of failure, regenerating an initialization parameter set and transmitting it to each lower controller, so as to reallocate the voltage output from each of remaining sub-modules in the cascaded STATCOM system.

According to one embodiment of the disclosure, it is preferred that the initialization parameter set comprises an initialization voltage value, an initialization phase angle and a nominal reactive power reference.

According to one embodiment of the disclosure, the step of generating an initialization parameter set in an upper controller for starting up the cascaded STATCOM system, further comprises sub-steps of:

generating the initialization voltage value and the initialization phase angle based on an amplitude value and a phase angle of a voltage detected from a power grid;

obtaining a nominal reactive power reference based on schedule and allocation of global system optimization.

According to one embodiment of the disclosure, the step of obtaining PWM real-time modulation signal further comprises sub-steps of:

calculating a current reactive power of the sub-module based on voltage and current output from a back end of the sub-module, so as to determine a phase angle reference of an output voltage;

calculating a current active power of the sub-module based on a voltage value detected on a front end DC capacitor of the of the sub-module and a voltage reference on the front end DC capacitor, so as to determine an amplitude reference of the output voltage;