breaker power systems. Embodiments described herein address certain shortcomings but not necessarily each and every one described here or known in the art. Furthermore, embodiments described herein may present other benefits than, and be used in other applications than, those of the shortcomings described above.

SUMMARY

[0010] A power system may include multiple generators and loads coupled to a main bus. Each generator and each load may be coupled to the main bus by way of an autonomous breaker. Each breaker may monitor the main bus to determine if power parameters of the bus are within a predetermined range. If a deviation of a power parameter from the predetermined range is detected, each of the breakers may open or close and adjust the loads and/or generators to which it is coupled based on the detection of the deviation. Breakers may also monitor for faults in the buses and devices to which they are coupled, and within themselves, and may refrain from closing if faults are detected. Thus, multiple generators and/or loads may autonomously couple to a main bus to maintain one or more power parameters of the main bus within a predetermined range.

[0010a] According to a first aspect, there is provided an apparatus, comprising: a first bus; an AC generator coupled to the first bus; a main bus; a first breaker coupled between the first bus and the main bus; and a first controller coupled to the first breaker and the AC generator; wherein the first controller is configured to perform steps comprising: detecting a deviation of a power parameter of the main bus from a predetermined range; closing the first breaker to couple the first bus to the main bus; and adjusting a power output of the generator to bring the power parameter of the main bus within the predetermined range.

[0010b] According to a second aspect, there is provided a method, comprising: detecting, by a first controller, a deviation of a power parameter of a main bus from a predetermined range; closing, by the first controller, a first breaker coupled between a first bus coupled to a generator and the main bus to couple the first bus to the main bus; and adjusting, by the first controller, a power output of the generator to bring the power parameter of the main bus within the predetermined range.

[0011] A power system, may include a first bus coupled to an AC generator and a main bus. A first breaker may couple the first bus to the main bus. An autonomous first controller may be coupled to the first breaker and the AC generator. The first controller may be further coupled to the main bus to detect deviations of one or more power parameters of the main bus from a predetermined range. When the first controller detects such a deviation, it may close the first breaker to couple the generator to the main bus. The first controller may also adjust a power output of the generator to bring the power parameter of the main bus within the predetermined range. The first controller may do so autonomously with no input from other controllers or breakers of the power system.

[0012] The first controller may also be configured to check for faults before coupling the generator to the main bus. For example, the first controller may determine that

CLAIMS

What is claimed is:

1. An apparatus, comprising:

a first bus;

an AC generator coupled to the first bus;

a main bus;

a first breaker coupled between the first bus and the main bus; and

a first controller coupled to the first breaker and the AC generator;

wherein the first controller is configured to perform steps comprising:

detecting a deviation of a power parameter of the main bus from a predetermined range;

closing the first breaker to couple the first bus to the main bus; and

adjusting a power output of the generator to bring the power parameter of the main bus within the predetermined range.

2. The apparatus of claim 1, further comprising:

a second bus;

a load coupled to the second bus;

a second breaker coupled between the second bus and the main bus;

a second controller coupled to the second breaker and the load;

wherein the second controller is configured to perform steps comprising:

detecting the deviation of the power parameter of the main bus from the predetermined range; and

adjusting the load to bring the power parameter of the main bus within the predetermined range.

3. The apparatus of claim 2, wherein the step of detecting, performed by the second controller, comprises detecting that the power parameter of the main bus has deviated from the predetermined range of acceptable values by at least a threshold value, and wherein the step of adjusting the load comprises opening the second breaker to decouple the second bus from the main bus.

4. The apparatus of claim 2, wherein the second controller is further configured to perform steps comprising:

detecting that there is no fault on the second bus; and

closing the second breaker after detecting that there is no fault on the second bus.

5. The apparatus of claim 1, wherein the first controller is further configured to perform steps comprising detecting that there is no fault on the first bus prior to closing the first breaker.

6. The apparatus of claim 1, wherein the first controller is further configured to perform steps comprising detecting that there is no fault on the main bus prior to closing the first breaker.

7. The apparatus of claim 1, wherein the first controller is further configured to perform steps comprising detecting that there is no fault in the first breaker, prior to closing the first breaker.

8. The apparatus of claim 1, wherein the power parameter comprises a frequency of power on the main bus.

9. A method, comprising:

detecting, by a first controller, a deviation of a power parameter of a main bus from a predetermined range;

closing, by the first controller, a first breaker coupled between a first bus coupled to a generator and the main bus to couple the first bus to the main bus; and

adjusting, by the first controller, a power output of the generator to bring the power parameter of the main bus within the predetermined range.

10. The method of claim 9, further comprising:

detecting, by a second controller, the deviation of the power parameter of the main bus from the predetermined range; and

adjusting a load coupled to a second bus, the second bus being coupled to the main bus via a second breaker, to bring the power parameter of the main bus within the predetermined range.

11. The method of claim 10, wherein the step of detecting, performed by the second controller, comprises detecting that the power parameter of the main bus has deviated from the predetermined range by at least a threshold value, and wherein the step of adjusting the load comprises opening the second breaker to decouple the second bus from the main bus.

12. The method of claim 11, further comprising adjusting a power output of a thruster of the load to maintain a voltage on a DC bus of the thruster within a predetermined range of voltages to prevent a shutdown of the thruster, after opening the second breaker.

13. The method of claim 10, further comprising

detecting, by the second controller, that there is no fault on the second bus; and

closing the second breaker, by the second controller after detecting that there is no fault on the second bus.

14. The method of claim 9, further comprising detecting, by the first controller, that there is no fault on the first bus prior to closing the first breaker.

15. The method of claim 9, further comprising detecting, by the first controller, that there is no fault on the main bus prior to closing the first breaker.

16. The method of claim 9, further comprising detecting, by the first controller, that there is no fault in the first breaker, prior to closing the first breaker.