[0066] Figure 4 is a flowchart of an embodiment of a method 150 for determining whether to change a direction of tuning the parameter 110. The method 150 is executed by one or more processors of the plasma system and is described with reference to Figure 1.

[0067] The operation 104 is performed. With reference to Figures 1 and 4, in an operation 154, the local minima 114 of the variable 106 is determined when the parameter 110 has the first value 124. Moreover, in an operation 156, the parameter 110 is tuned by changing the first value 124 to one or more other values, e.g., the second value 126, the value 160, etc., in the direction 166.

[0068] In an operation 158, when the parameter 110 is tuned to the one or more other values, a number of events for which the variable 106 is unstable is determined. For example, it is determined whether the variable 106 is unstable when the parameter 110 has the second value 126 and whether the variable 106 is unstable when the parameter 110 has the value 160. In this example, upon determining that the variable 106 is unstable when the parameter 110 has the value 160 and that the variable 106 is unstable when the parameter 110 has the second value 126, it is determined that two events are created, one at each of the values 126 and 160 of the parameter 110. Moreover, in this example, upon determining that the variable 106 is unstable when the parameter 110 has the value 160 and that the variable 106 is stable when the parameter 110 has the second value 126, it is determined that one event has occurred at the value 160.

[0069] In an embodiment, instead of determining whether the variable 106 is unstable when the parameter 110 has a value to determine a number of events, it is determined whether the variable 106 exceeds the threshold when the parameter has the value to determine the number of events. For example, it is determined whether the variable 106 exceeds the threshold when the parameter 110 has the second value 126 and whether the variable ~~160~~ 106 exceeds the threshold when the parameter 110 has the value 160. In this

CLAIMS

1. A method for tuning a parameter associated with plasma impedance, comprising:

receiving information to determine a variable, the information measured at a transmission line, the information measured when the parameter has a first value, the transmission line used to provide power to a plasma chamber via an impedance matching circuit;

determining whether the variable is at a local minima;

providing the first value to tune the impedance matching circuit upon determining that the variable is at the local minima;

changing the first value to a second value of the parameter upon determining that the variable is not at the local minima; and

determining whether the variable is at a local minima when the parameter has the second value,

wherein the method is executed by a processor.

2. The method of claim 1, wherein the parameter includes frequency, capacitance, inductance, or a combination thereof.

3. The method of claim 1, wherein the information includes voltage, current, power, or a combination thereof, wherein the variable includes gamma, reflected power, complex voltage reflection coefficient, plasma impedance, or a combination thereof.

4. The method of claim 1, wherein the local minima is other than an absolute minima, wherein the absolute minima includes a reflected power of zero watts.

5. The method of claim 1, wherein the processor is within a host system, the host system coupled to a radio frequency (RF) generator, the RF generator coupled to the plasma chamber via the impedance matching circuit.

6. The method of claim 1, wherein the method is executed during processing of a substrate, wherein the method is performed without using a learned value of the parameter.

7. The method of claim 6, wherein the substrate is implemented within an electronic device.

8. The method of claim 1, wherein said determining whether the variable is at a local minima when the parameter has a first value comprises:

determining whether the variable exceeds a threshold when the parameter has the first value; or

determining whether the variable is stable when the parameter has the first value; or a combination thereof.

9. The method of claim 8, wherein the variable is stable when the variable lacks oscillation.

10. The method of claim 8, wherein the variable is unstable when the variable oscillates between a minimum value and a maximum value, and a range between the minimum value and the maximum value exceeds a predetermined range.

CLAIMS

1. A method for tuning a parameter associated with plasma impedance, comprising:

receiving information to determine a variable, the information measured at a transmission line, the information measured when the parameter has a first value, the transmission line used to provide power to a plasma chamber via an impedance matching circuit;

determining whether the variable is at a local minima when the parameter has the first value;

providing the first value to tune the impedance matching circuit upon determining that the variable is at the local minima;

changing the first value to a second value of the parameter upon determining that the variable is not at the local minima; and

determining whether the variable is at a local minima when the parameter has the second value,

wherein the method is executed by a processor.

2. The method of claim 1, wherein said determining whether the variable is at a local minima when the parameter has the first value comprises:

determining whether the variable exceeds a threshold when the parameter has the first value; or

determining whether the variable is stable when the parameter has the first value; or

a combination thereof.

3. The method of claim 2, wherein the variable is stable when the variable lacks oscillation.

4. The method of claim 2, wherein the variable is unstable when the variable oscillates between a minimum value and a maximum value, and a range between the minimum value and the maximum value exceeds a predetermined range.

5. The method of claim 1, wherein the method is executed during processing of a substrate, wherein the method is performed without using a learned value of the parameter.

6. The method of claim 5, wherein the substrate is implemented within an electronic device.

7. The method of claim 1, wherein the parameter includes frequency, capacitance, inductance, or a combination thereof.

8. The method of claim 1, wherein the information includes voltage, current, power, or a combination thereof, wherein the variable includes gamma, reflected power, complex voltage reflection coefficient, plasma impedance, or a combination thereof.

9. The method of claim 1, wherein the local minima is other than an absolute minima, wherein the absolute minima includes a reflected power of zero watts.

10. The method of claim 1, wherein the processor is within a host system, the host system coupled to a radio frequency (RF) generator, the RF generator coupled to the plasma chamber via the impedance matching circuit.

11. A method for tuning a parameter associated with plasma impedance, comprising:

receiving information to determine a variable, the information measured at a transmission line, the information measured when the parameter has a first value, the transmission line used to provide power to a plasma chamber via an impedance matching circuit;

determining whether the variable is at a local minima when the parameter has the first value;

providing the first value to generate a radio frequency (RF) signal upon determining that the variable is at the local minima, the RF signal corresponding to the first value, the RF signal to be sent to the plasma chamber;

changing the first value to a second value of the parameter upon determining that the variable is not at the local minima; and

determining whether the variable is at a local minima when the parameter has the second value,

wherein the method is executed by a processor.

12. The method of claim 11, wherein said determining whether the variable is at a local minima when the parameter has the first value comprises:

determining whether the variable exceeds a threshold when the parameter has the first value; or

determining whether the variable is stable when the parameter has the first value; or

a combination thereof.

13. The method of claim 11, wherein the information includes voltage, current, power, or a combination thereof, wherein the variable includes gamma, reflected power, complex voltage reflection coefficient, plasma impedance, or a combination thereof.

14. A method for tuning a parameter associated with plasma impedance, comprising:

receiving information to determine a variable, the information measured at a transmission line, the information measured when the parameter has a first value, the transmission line used to provide power to a plasma chamber via an impedance matching circuit;

determining whether the variable is at a local minima when the parameter has the first value;

determining whether the first value of the parameter is within a limit of a learned value upon determining that the variable is at the local minima, the learned value determined during a learning routine;

providing the learned value to generate a radio frequency (RF) signal or to tune the impedance matching circuit upon determining that the first value of the parameter is within the limit; and

changing the first value to a second value of the parameter upon determining that the parameter has the first value that is outside the limit,

wherein the method is executed by a processor.

15. The method of claim 14, wherein said determining whether the variable is at a local minima when the parameter has the first value comprises:

determining whether the variable exceeds a threshold when the parameter has the first value; and

determining whether the variable is stable when the parameter has the first value.

16. The method of claim 15, wherein the variable is unstable when the variable oscillates between a minimum value and a maximum value, and a range between the minimum value and the maximum value exceeds a predetermined range.

17. The method of claim 16, wherein the variable is stable when the variable lacks oscillation.

18. The method of claim 15, wherein the method is executed during processing of a substrate.

19. The method of claim 18, wherein the substrate is implemented within an electronic device.

20. A method for tuning a parameter associated with plasma impedance, comprising:

receiving information to determine a variable, the information measured at a transmission line, the information measured when the parameter has a first value, the transmission line used to provide power to a plasma chamber via an impedance matching circuit;

determining a local minima of the variable, the local minima achieved when the parameter has the first value;

tuning the parameter by changing the first value to one or more other values of the parameter;

determining a number of events for which the variable is unstable when the parameter has the one or more other values;

determining whether the number of events exceeds a boundary;

reversing a direction of tuning the parameter upon determining that the number of events exceeds the boundary; and

discontinuing further tuning of the parameter upon determining that the number of events does not exceed the boundary,

wherein the method is executed by a processor.

21. The method of claim 20, wherein said determining the local minima of the variable comprises:

determining that the variable does not exceed a threshold when the parameter has the first value; and

determining that the variable is stable when the parameter has the first value.

22. The method of claim 20, wherein said reversing the direction of tuning the parameter includes increasing a value of the parameter or decreasing a value of the parameter.

23. The method of claim 20, wherein the method is executed during processing of a substrate, wherein the method is performed without knowledge of a learned value of the parameter, wherein the local minima is other than an absolute minima, wherein the processor is within a host system, the host system coupled to a radio frequency (RF) generator, the RF generator coupled to the plasma chamber via the impedance matching circuit.

24. The method of claim 20, wherein the method is executed during processing of a substrate, wherein the substrate is implemented within an electronic device.