CLAIMS

What is claimed is:

1. A radio frequency (RF) generation system, comprising:

an impedance determination module that receives an RF voltage and an RF current and that determines an RF generator impedance based on the RF voltage and the RF current;

a control module that determines a plurality of electrical values based on the RF generator impedance;

a matching module that:

matches an impedance of a load based on the RF generator impedance and the plurality of electrical values; and

determines a 2 port transfer function based on the plurality of electrical values; and

a virtual sensor module that estimates a load voltage, a load current, and a load impedance based on the RF voltage, the RF current, the RF generator impedance, and the 2 port transfer function.

2. The RF generation system of claim 1 wherein the RF generator impedance is a predetermined value.

3. The RF generation system of claim 1 wherein the matching module selectively adjusts a plurality of electrical components based on the plurality of electrical values and wherein the plurality of electrical components includes a capacitance value, an inductance value, and a resistance value, wherein the capacitance value, the inductance value, and the resistance value are represented by an ABCD matrix.

4. The RF generation system of claim 1 wherein the virtual sensor module estimates the load voltage and load current based on a mathematical relationship between the RF voltage, the RF current, the RF generator impedance, and the 2 port transfer function.

5. The RF generation system of claim 3 wherein the plurality of electrical components includes a plurality of capacitors, a plurality of inductors, and a plurality of resistors.

6. The RF generation system of claim 1 further comprising a sensor module that measures the RF voltage and the RF current.

7. The RF generation system of claim 1 wherein the impedance determination module determines the RF generator impedance based on a ratio of the RF voltage to the RF current.

8. The RF generation system of claim 1 wherein the virtual sensor module determines an ABCD matrix for each of the plurality of electrical values and determines an total ABCD matrix based on each of the ABCD matrices of each of the plurality of electrical values.

9 The RF generation system of claim 8 wherein the virtual sensor module estimates the load voltage and the load current based on a relationship between an inverse of the total ABCD matrix, the RF voltage, and the RF current.

10. the RF generation system of claim 1 wherein the 2 port transfer function is a predetermined value.

11. A radio frequency (RF) generation method, comprising:

receiving an RF voltage and an RF current;

determining an RF generator impedance based on the RF voltage and the RF current;

determining a plurality of electrical values based on the RF generator impedance;

selectively adjusting a plurality of electrical components based on the plurality of electrical values;

matching an impedance of a load based on the RF generator impedance and the electrical components;

determining a 2 port transfer function based on the plurality of electrical values; and

estimating a load voltage, a load current, and a load impedance based on the RF voltage, the RF current, the RF generator impedance, and the 2 port transfer function.

12. The RF generation method of claim 11 wherein the RF generator impedance is a predetermined value.

13. The RF generation method of claim 11 wherein the plurality of electrical components includes a capacitance value, an inductance value, and a resistance value and wherein the capacitance value, the inductance value, and the resistance value are represented by an ABCD matrix.

14. The RF generation method of claim 11 further comprising estimating the load voltage and load current based on a mathematical relationship between the RF voltage, the RF current, the RF generator impedance, and the 2 port transfer function.

15. The RF generation method of claim 11 wherein the plurality of electrical components includes a plurality of capacitors, a plurality of inductors, and a plurality of resistors.

16. The RF generation method of claim 11 further comprising measuring the RF voltage and the RF current.

17. The RF generation method of claim 11 further comprising determining the RF generator impedance based on a ratio of the RF voltage to the RF current.

18. The RF generation method of claim 11 further comprising determining an ABCD matrix for each of the plurality of electrical values and determining an total ABCD matrix based on each of the ABCD matrices of each of the plurality of electrical values.

19 The RF generation method of claim 18 further comprising estimating the load voltage and the load current based on a relationship between an inverse of the total ABCD matrix, the RF voltage, and the RF current.

20. The RF generation method of claim 11 wherein the 2 port transfer function is a predetermined value.

CLAIMS

What is claimed is:

1. A radio frequency (RF) generation system, comprising:

an impedance determination module that receives an RF voltage and an RF current and that determines an RF generator impedance based on the RF voltage and the RF current;

a control module that determines a plurality of electrical values based on the RF generator impedance;

a matching module that:

matches an impedance of a load based on the RF generator impedance and the plurality of electrical values; and

determines a 2 port transfer function based on the plurality of electrical values; and

a virtual sensor module that estimates a load voltage, a load current, and a load impedance based on the RF voltage, the RF current, the RF generator impedance, and the 2 port transfer function.

2. The RF generation system of claim 1 wherein the matching module selectively adjusts a plurality of electrical components based on the plurality of electrical values and wherein the plurality of electrical components includes a capacitance value, an inductance value, and a resistance value, wherein the capacitance value, the inductance value, and the resistance value are represented by an ABCD matrix.

3. The RF generation system of claim 2 wherein the plurality of electrical components includes a plurality of capacitors, a plurality of inductors, and a plurality of resistors.

4. The RF generation system of claim 1 wherein the virtual sensor module determines an ABCD matrix for each of the plurality of electrical values and determines

an total ABCD matrix based on each of the ABCD matrices of each of the plurality of electrical values.

5. The RF generation system of claim 4 wherein the virtual sensor module estimates the load voltage and the load current based on a relationship between an inverse of the total ABCD matrix, the RF voltage, and the RF current.

6. The RF generation system of claim 1 wherein the RF generator impedance is a predetermined value.

7. The RF generation system of claim 1 wherein the virtual sensor module estimates the load voltage and load current based on a mathematical relationship between the RF voltage, the RF current, the RF generator impedance, and the 2 port transfer function.

8. The RF generation system of claim 1 further comprising a sensor module that measures the RF voltage and the RF current.

9. The RF generation system of claim 1 wherein the impedance determination module determines the RF generator impedance based on a ratio of the RF voltage to the RF current.

10. The RF generation system of claim 1 wherein the 2 port transfer function is a predetermined value.

11. A radio frequency (RF) generation method, comprising:

receiving an RF voltage and an RF current;

determining an RF generator impedance based on the RF voltage and the RF current;

determining a plurality of electrical values based on the RF generator impedance;

selectively adjusting a plurality of electrical components based on the plurality of electrical values;

matching an impedance of a load based on the RF generator impedance and the electrical components;

determining a 2 port transfer function based on the plurality of electrical values; and

estimating a load voltage, a load current, and a load impedance based on the RF voltage, the RF current, the RF generator impedance, and the 2 port transfer function.

12. The RF generation method of claim 11 further comprising determining an ABCD matrix for each of the plurality of electrical values and determining an total ABCD matrix based on each of the ABCD matrices of each of the plurality of electrical values.

13. The RF generation method of claim 12 further comprising estimating the load voltage and the load current based on a relationship between an inverse of the total ABCD matrix, the RF voltage, and the RF current.

14. The RF generation method of claim 11 wherein the RF generator impedance is a predetermined value.

15. The RF generation method of claim 11 wherein the plurality of electrical components includes a capacitance value, an inductance value, and a resistance value and wherein the capacitance value, the inductance value, and the resistance value are represented by an ABCD matrix.

16. The RF generation method of claim 11 further comprising estimating the load voltage and load current based on a mathematical relationship between the RF voltage, the RF current, the RF generator impedance, and the 2 port transfer function.

17. The RF generation method of claim 11 wherein the plurality of electrical components includes a plurality of capacitors, a plurality of inductors, and a plurality of resistors.

18. The RF generation method of claim 11 further comprising measuring the RF voltage and the RF current.

19. The RF generation method of claim 11 further comprising determining the RF generator impedance based on a ratio of the RF voltage to the RF current.

20. The RF generation method of claim 11 wherein the 2 port transfer function is a predetermined value.