WHAT IS CLAIMED IS:

1. A polishing apparatus comprising:

a rotatable polishing table that can hold a polishing pad having a polishing surface;

a top ring that presses a substrate to be polished against the polishing surface and can polish a conductive film on the substrate;

an eddy current sensor disposed in the polishing table; and

a monitoring apparatus that can monitor a film thickness of the conductive film based on an output of the eddy current sensor, wherein

the output of the eddy current sensor includes an impedance component,

the monitoring apparatus obtains film thickness information from the impedance component and can calculate the film thickness from the film thickness information using correspondence information indicating a non-linear relationship between the film thickness information and the film thickness, and

when a resistance component and a reactance component of the impedance component are associated with the respective axes of a coordinate system having two orthogonal coordinate axes, the film thickness information is a reciprocal of a tangent of an impedance angle, which is an angle formed between a straight line connecting a point on the coordinate system corresponding to the impedance component and a predetermined reference point, and a predetermined straight line.

2. The polishing apparatus according to claim 1, wherein the correspondence information includes information indicating that the film thickness is a quadratic function of the reciprocal.

3. The polishing apparatus according to claim 1, wherein the correspondence information includes information indicating that the film thickness is an exponential function of the reciprocal.

4. The polishing apparatus according to claim 1, further comprising:

a temperature sensor that can directly or indirectly measure a temperature of the substrate under polishing; and

a temperature correction unit that can correct the obtained film thickness using the measured temperature.

5. A calibration method for a first eddy current sensor disposed in a polishing table to monitor a film thickness of a conductive film when a substrate to be polished is pressed against a polishing surface of a polishing pad held by the polishing table to polish the conductive film on the substrate, the calibration method comprising:

preparing at least three substrates in which the at least three substrates are a first substrate having a first film thickness, a second substrate having a second film thickness and a third substrate having a third film thickness, and the first film thickness, the second film thickness and the third film thickness are different from one another;

measuring the first, second and third substrates using the first eddy current sensor to obtain first, second and third film thickness information from an impedance component of an output of the first eddy current sensor for the first, second and third substrates respectively;

obtaining correspondence information indicating a non-linear relationship between the first, second and third film thicknesses and the corresponding first, second and third film thickness information from at least the first, second and third film thicknesses and at least the first, second and third film thickness information; and

disposing a second eddy current sensor in the polishing table to monitor a film thickness of the conductive film;

measuring the first, second and third substrates using the second eddy current sensor and obtaining fourth, fifth and sixth film thickness information from an impedance component of an output of the second eddy current sensor for the first, second and third substrates respectively;

measuring the first, second and third substrates using the first eddy current sensor at positions of the first, second and third substrates measured using the second eddy current

sensor and obtaining seventh, eighth and ninth film thickness information for the first, second and third substrates respectively;

calculating fourth, fifth and sixth film thicknesses from the seventh, eighth and ninth film thickness information using the correspondence information obtained for the first eddy current sensor; and

obtaining correspondence information indicating a non-linear relationship between film thickness information and a film thickness of the second eddy current sensor indicating a relationship between the fourth, fifth and sixth film thicknesses and the corresponding fourth, fifth and sixth film thickness information from at least the fourth, fifth and sixth film thicknesses and at least the fourth, fifth and sixth film thickness information.

6. A calibration method for a first eddy current sensor disposed on a polishing table to monitor a film thickness of a conductive film when a substrate to be polished is pressed against a polishing surface of a polishing pad held by the polishing table to polish the conductive film on the substrate, the calibration method comprising:

preparing at least one first substrate having a first film thickness and at least one second substrate having a second film thickness, the first film thickness being different from the second film thickness;

measuring the first and second substrates using the first eddy current sensor and obtaining first and second film thickness information from an impedance component of an output of the first eddy current sensor for the first and second substrates respectively;

polishing the second substrate, obtaining the second substrate having a third film thickness, then measuring the second substrate using the first eddy current sensor and obtaining third film thickness information from an impedance component of the output of the first eddy current sensor;

measuring a film thickness of the second substrate after polishing using a film thickness measuring machine and obtaining the third film thickness;

obtaining correspondence information indicating a non-linear relationship between the first, second and third film thicknesses and the corresponding first, second and third film

thickness information from at least the first, second and third film thicknesses and at least the first, second and third film thickness information; and

disposing a second eddy current sensor in the polishing table to monitor the film thickness of the conductive film;

measuring the first and second substrates using the second eddy current sensor and obtaining fourth and fifth film thickness information from an impedance component of an output of the second eddy current sensor for the first substrate and the second substrate before polishing respectively;

measuring the second substrate using the second eddy current sensor and obtaining sixth film thickness information from an impedance component of the output of the second eddy current sensor for the second substrate after polishing;

measuring the first and second substrates using the first eddy current sensor at positions of the first and second substrates at which the second eddy current sensor measures the first and second substrates and obtaining seventh, eighth and ninth film thickness information for the first substrate and the second substrate having the second and third film thicknesses respectively;

calculating fourth, fifth and sixth film thicknesses from the seventh, eighth and ninth film thickness information using the correspondence information obtained for the first eddy current sensor; and

obtaining correspondence information indicating a non-linear relationship between film thickness information and a film thickness of the second eddy current sensor indicating a relationship between the fourth, fifth and sixth film thicknesses and the corresponding fourth, fifth and sixth film thickness information from at least the fourth, fifth and sixth film thicknesses and at least the fourth, fifth and sixth film thickness information.

7. A calibration method for a first eddy current sensor disposed in a polishing table to monitor a film thickness of a conductive film when a substrate to be polished is pressed against a polishing surface of a polishing pad held by the polishing table to polish the conductive film on the substrate, the calibration method comprising:

preparing at least one substrate having a first film thickness;

measuring the substrate using the first eddy current sensor and obtaining first film thickness information from an impedance component of an output of the first eddy current sensor for the substrate;

polishing the substrate, obtaining the substrate having a second film thickness, then measuring the substrate using the first eddy current sensor and obtaining second film thickness information from an impedance component of the output of the first eddy current sensor;

measuring a film thickness of the substrate having the second film thickness using a film thickness measuring machine and obtaining the second film thickness;

polishing the substrate having the second film thickness, obtaining the substrate having a third film thickness, then measuring the substrate using the first eddy current sensor and obtaining third film thickness information from an impedance component of the output of the first eddy current sensor;

measuring a film thickness of the substrate having the third film thickness using the film thickness measuring machine and obtaining the third film thickness;

obtaining correspondence information indicating a non-linear relationship between the first, second and third film thicknesses and the corresponding first, second and third film thickness information from at least the first, second and third film thicknesses and at least the first, second and third film thickness information; and

disposing a second eddy current sensor in the polishing table to monitor a film thickness of the conductive film;

measuring the substrate using the second eddy current sensor and obtaining fourth film thickness information from an impedance component of the output of the second eddy current sensor for the substrate having the first film thickness;

measuring the substrate using the second eddy current sensor and obtaining fifth film thickness information from an impedance component of the output of the second eddy current sensor for the substrate having the second film thickness;

measuring the substrate using the second eddy current sensor and obtaining sixth film thickness information from an impedance component of the output of the second eddy current sensor for the substrate having the third film thickness;

measuring the substrate using the first eddy current sensor at positions of the substrate at which the second eddy current sensor measures the substrate and obtaining seventh, eighth and ninth film thickness information for the substrates having the first, second and third film thicknesses respectively;

calculating fourth, fifth and sixth film thicknesses from the seventh, eighth and ninth film thickness information using the correspondence information obtained for the first eddy current sensor; and

obtaining correspondence information indicating a non-linear relationship between film thickness information and a film thickness of the second eddy current sensor indicating a relationship between the fourth, fifth and sixth film thicknesses and the corresponding fourth, fifth and sixth film thickness information from at least the fourth, fifth and sixth film thicknesses and at least the fourth, fifth and sixth film thickness information.

8. The calibration method according to claim 5, wherein the first film thickness is substantially 0 mm.