What is claimed is:

1. A substrate cleaning device comprising:

a cleaning member configured to clean a substrate by contacting the substrate;

a member rotation unit configured to rotate the cleaning member;

a member drive unit configured to press the cleaning member against the substrate;

a load measurement unit configured to measure a pressing load of the cleaning member; and

a control unit configured to control a pressing amount of the cleaning member by the member drive unit, on the basis of a measurement value of the load measurement unit, so that the pressing load of the cleaning member becomes a setting load, wherein

the control unit repeats an operation of comparing the measurement value of the load measurement unit with the setting load, changing the pressing amount of the cleaning member by a first movement amount so that a difference value decreases, when the difference value is larger than a first threshold value and equal to or smaller than a second threshold value, and changing the pressing amount of the cleaning member by a second movement amount larger than the first movement amount so that the difference value decreases, when the difference value is larger than the second threshold value, until the difference value becomes

equal to or smaller than the first threshold value.

2. The substrate cleaning device according to claim 1, wherein

the cleaning member is any one member of a group consisting of a roll cleaning member, a pencil cleaning member, and a buff cleaning/polishing member.

3. The substrate cleaning device according to claim 1 or 2, wherein

the member drive unit is an electric actuator.

4. A substrate processing apparatus comprising the substrate cleaning device according to any one of claims 1 to 3.

5. A substrate cleaning method comprising:

a step of causing a member drive unit to press a cleaning member against a substrate;

a step of causing a load measurement unit to measure a pressing load of the cleaning member; and

a step of causing a control unit to control a pressing amount of the cleaning member by the member drive unit, on the basis of a measurement value of the load measurement unit, so that the pressing load of the cleaning member becomes a setting load, wherein

in the step of controlling the pressing amount, the

control unit repeats an operation of comparing the measurement value of the load measurement unit with the setting load, changing the pressing amount of the cleaning member by a first movement amount so that a difference value decreases, when the difference value is larger than a first threshold value and equal to or smaller than a second threshold value, and changing the pressing amount of the cleaning member by a second movement amount larger than the first movement amount so that the difference value decreases, when the difference value is larger than the second threshold value, until the difference value becomes equal to or smaller than the first threshold value.

6. The substrate cleaning method according to claim 5, wherein

the cleaning member is any one member of a group consisting of a roll cleaning member, a pencil cleaning member, and a buff cleaning/polishing member.

7. The substrate cleaning method according to claim 5 or 6, wherein

the member drive unit is an electric actuator.