CLAIMS

[Claim 1] An information processing apparatus comprising:

an information acquisition section configured to acquire finishing conditions including substrate-holder state information indicating a state of a substrate holder and a finishing-fluid-supply-structure state information indicating a state of a finishing-fluid supply structure in a finishing process of a substrate performed by a substrate processing apparatus including the substrate holder configured to hold the substrate and the finishing-fluid supply structure configured to supply a substrate finishing fluid onto the substrate; and

a state prediction section configured to predict substrate state information for the substrate on which the finishing process is performed under the finishing conditions by inputting the finishing conditions acquired by the information acquisition section to a learning model that has been generated by machine learning that causes the learning model to learn a correlation between the finishing conditions and substrate state information indicating a state of the substrate on which the finishing process is performed under the finishing conditions, the substrate state information comprising stress information indicating stress applied to the substrate.

[Claim 2] The information processing apparatus according to claim 1, wherein the substrate holder includes:

a substrate rotating mechanism configured to rotate the substrate about a first rotation axis perpendicular to a finishing-target surface of the substrate; and

a substrate holding mechanism configured to hold a side edge of the substrate,

the substrate-holder state information included in the finishing conditions includes at least one of:

the number of holding points at which the substrate holding mechanism holds the substrate;

a holding pressure at which the substrate holding mechanism holds the substrate;

a rotation speed of the substrate rotating mechanism;

a rotation torque of the substrate rotating mechanism; and

a condition of the substrate holding mechanism.

[Claim 3] The information processing apparatus according to claim 1 or 2, wherein the finishing-fluid-supply-structure state information included in the finishing conditions includes at least one of:

a flow rate of the substrate finishing fluid;

a pressure of the substrate finishing fluid;

a dropping position of the substrate finishing fluid;

a temperature of the substrate finishing fluid; and

a concentration of the substrate finishing fluid.

[Claim 4] The information processing apparatus according to any one of claims 1 to 3, wherein the finishing conditions further include device internal-environment information indicating an environment of a space in which the finishing processing is performed, and the device internal-environment information included in the finishing conditions includes at least one of:

a temperature in the space;

a humidity in the space;

an atmospheric pressure of the space;

an airflow in the space;

an oxygen concentration in the space; and

sound in the space.

[Claim 5] The information processing apparatus according to any one of claims 1 to 4, wherein the finishing conditions further include unprocessed substrate information indicating a state of an unprocessed substrate which is the substrate before the finishing

process is performed.

[Claim 6] The information processing apparatus according to claim 5, wherein the unprocessed substrate information included in the finishing conditions includes at least one of:

a shape of the unprocessed substrate;

a weight of the unprocessed substrate; and

a condition of a substrate surface of the unprocessed substrate.

[Claim 7] The information processing apparatus according to any one of claims 1 to 6, wherein the finishing conditions comprise cleaning conditions in a cleaning process of the substrate performed as the finishing process by the substrate processing apparatus.

[Claim 8] The information processing apparatus according to claim 7, wherein the substrate processing apparatus further comprises a substrate cleaning structure configured to rotatably support a cleaning tool and bring the cleaning tool into contact with the substrate to clean the substrate, and

the cleaning conditions further include substrate-cleaning-structure state information indicating a state of the substrate cleaning structure.

[Claim 9] The information processing apparatus according to claim 8, wherein the substrate cleaning structure includes:

a cleaning-tool rotating mechanism configured to rotate the cleaning tool about a second rotation axis parallel to a cleaning-target surface of the substrate or about a third rotation axis perpendicular to the cleaning-target surface; and

a cleaning-tool moving mechanism configured to move a relative position of the cleaning tool and the cleaning-target surface, and

the substrate-cleaning-structure state information included in the finishing

conditions includes at least one of:

a rotation speed of the cleaning-tool rotating mechanism;

a rotation torque of the cleaning-tool rotating mechanism;

position coordinates of the cleaning-tool moving mechanism;

a movement speed of the cleaning-tool moving mechanism;

a movement torque of the cleaning-tool moving mechanism;

a pressing load at which the cleaning tool is brought into contact with the substrate, and

a condition of the cleaning tool.

[Claim 10] The information processing apparatus according to any one of claims 1 to 6, wherein the finishing conditions comprise drying conditions in a cleaning process of the substrate performed as the finishing process by the substrate processing apparatus.

[Claim 11] The information processing apparatus according to any one of claims 1 to 11, wherein

the stress information indicates at least one of mechanical stress and thermal stress applied to the substrate.

[Claim 12] The information processing apparatus according to claim 11, wherein the stress information indicates:

an instantaneous value of the stress at a target point-in-time included in a finishing-process period from start to end of the finishing process; or

an accumulated value of the stress in a target period from the start of the finishing process to the target point-in-time.

[Claim 13] The information processing apparatus according to claim 11 or 12, wherein the stress information indicates an in-plane distribution state of the stress applied

to a substrate surface of the substrate.

[Claim 14] The information processing apparatus according to any one of claims 7 to 9, wherein the substrate state information comprises finishing quality information indicating a finishing quality of the substrate, and

the finishing quality information comprises cleaning quality information indicating a cleaning quality of the substrate in the cleaning process.

[Claim 15] The information processing apparatus according to claim 10, wherein the substrate state information comprises finishing quality information indicating a finishing quality of the substrate, and

the finishing quality information comprises drying quality information indicating a drying quality of the substrate in the drying process.

[Claim 16] The information processing apparatus according to any one of claims 1 to 10, wherein the learning model comprises:

a learning model for stress analysis that has been generated by machine learning that causes the learning model for stress analysis to learn a correlation between the finishing conditions and stress information indicating stress applied to the substrate on which the finishing process is performed under the finishing conditions; and

a learning model for finishing-quality analysis that has been generated by machine learning that causes the learning model for finishing-quality analysis to learn a correlation between the stress information and finishing quality information indicating a finishing quality of the substrate to which the stress indicated by the stress information is applied, and

the state prediction section is configured to:

predict the stress information for the substrate on which the finishing process under the finishing conditions is performed by inputting the finishing conditions

acquired by the information acquisition section to the learning model for the stress analysis; and

predict the finishing quality information for the substrate to which the stress indicated by the stress information is applied by inputting the predicted stress information to the learning model for the finishing-quality analysis.

[Claim 17] An inference apparatus comprising:

a memory; and

a processor configured to perform:

an information acquisition process of acquiring finishing conditions including substrate-holder state information indicating a state of a substrate holder and a finishing-fluid-supply-structure state information indicating a state of a finishing-fluid supply structure in a finishing process of a substrate performed by a substrate processing apparatus including the substrate holder configured to hold the substrate and the finishing-fluid supply structure configured to supply a substrate finishing fluid onto the substrate; and

an inference process of inferring substrate state information indicating a state of the substrate on which the finishing process is performed under the finishing conditions when the finishing conditions are acquired in the information acquisition process, the substrate state information comprising stress information indicating stress applied to the substrate.

[Claim 18] An inference apparatus comprising:

a memory; and

a processor configured to perform:

an information acquisition process of acquiring stress information indicating stress applied to a substrate on which a finishing process is performed by a substrate processing apparatus including a substrate holder configured to hold the

substrate and a finishing-fluid supply structure configured to supply a substrate finishing fluid onto the substrate; and

an inference process of inferring finishing quality information indicating a finishing quality of the substrate to which the stress indicated by the stress information is applied when the stress information is acquired in the information acquisition process.

[Claim 19] A machine-learning apparatus comprising:

a learning-data storage section storing multiple sets of learning data including finishing conditions and substrate state information, the finishing conditions including substrate-holder state information indicating a state of a substrate holder and a finishing-fluid-supply-structure state information indicating a state of a finishing-fluid supply structure in a finishing process of a substrate performed by a substrate processing apparatus including the substrate holder configured to hold the substrate and the finishing-fluid supply structure configured to supply a substrate finishing fluid onto the substrate, the substrate state information indicating a state of the substrate on which the finishing process is performed under the finishing conditions, the substrate state information comprising stress information indicating stress applied to the substrate;

a machine-learning section configured to cause a learning model to learn a correlation between the finishing conditions and the substrate state information by inputting the multiple sets of learning data to the learning model; and

a learned-model storage section configured to store the learning model that has learned the correlation by the machine-learning section.

[Claim 20] A machine-learning apparatus comprising:

a learning-data storage section storing multiple sets of learning data including stress information and finishing quality information, the stress information indicating stress applied to a substrate on which a finishing process is performed by a substrate

processing apparatus including a substrate holder configured to hold the substrate and a finishing-fluid supply structure configured to supply a substrate finishing fluid onto the substrate, the finishing quality information indicating a finishing quality of the substrate to which the stress indicated by the stress information is applied;

a machine-learning section configured to cause a learning model to learn a correlation between the stress information and the finishing quality information by inputting the multiple sets of learning data to the learning model; and

a learned-model storage section configured to store the learning model that has learned the correlation by the machine-learning section.