{CLAIMS}

{Claim 1}

A lift-conveyor control device of a mechanical parking apparatus that includes:

a lift conveyor that is installed in a structure having a plurality of floors and goes up and down with a vehicle placed thereon;

a motor that raises and lowers the lift conveyor; and

storage sheves provided on the plurality of floors along a hoistway along which the lift conveyor goes up and down, the lift-conveyor control device comprising:

weight estimation means for estimating a weight of the vehicle placed on the lift conveyor when the vehicle is loaded;

derivation means for deriving an acceleration, a deceleration, and a maximum speed at which the lift conveyor is raised and lowered based on the weight of the vehicle estimated by the weight estimation means; and

motor control means for controlling the motor so as to accelerate the lift conveyor, with the vehicle placed thereon and at a standstill, based on the acceleration derived by the derivation means and to stop the lift conveyor at a pre-specified floor by decelerating the lift conveyor based on the deceleration derived by the derivation means after the maximum

speed derived by the derivation means is reached.

{Claim 2}

The lift-conveyor control device according to Claim 1, wherein

when the speed of the lift conveyor reaches the maximum speed, the motor control means maintains the speed at the maximum speed for a predetermined period of time and decelerates the lift conveyor based on the deceleration.

{Claim 3}

The lift-conveyor control device according to Claim 1 or 2, further comprising:

storage means for storing information about vehicles stored on the storage shelves and information about the weights of the vehicle estimated by the weight estimation means in association with each other, wherein

the derivation means reads out the information about the weight of the vehicle raised and lowered with the lift conveyor from the storage means and derives the acceleration, deceleration, and maximum speed at which the lift conveyor is raised and lowered based on the read-out information.

{Claim 4}

The lift-conveyor control device according to Claim 3,

wherein

when the vehicle is being unloaded, the derivation means reads out the information about the weight of the vehicle to be unloaded from the storage means and derives the acceleration, deceleration, and maximum speed at which the lift conveyor is raised and lowered based on the read-out information.

{Claim 5}

The lift-conveyor control device according to one of Claims 1 to 4, wherein

in the case of at least one of loading and unloading of the vehicle, the motor control means controls the motor so as to accelerate the lift conveyor, with the vehicle placed thereon and at a standstill, after a torque based on the weight of the vehicle is produced.

{Claim 6}

The lift-conveyor control device according to one of Claims 1 to 5, wherein

the derivation means derives a positive jerk and a negative jerk, as well as the acceleration, deceleration, and maximum speed at which the lift conveyor is raised and lowered, based on the weight of the vehicle estimated by the weight estimation means; and

the motor control means controls the motor so as to accelerate the lift conveyor, with the vehicle placed thereon and at a standstill, based on the acceleration and the positive jerk derived by the derivation means and to stop the lift conveyor at the pre-specified floor by decelerating the lift conveyor based on the deceleration and the negative jerk derived by the derivation means after the maximum speed derived by the derivation means is reached.

{Claim 7}

The lift-conveyor control device according to one of Claims 1 to 6, wherein

the weight estimation means estimates the weight of the vehicle based on the torque that is produced by the motor when the lift conveyor having the vehicle placed thereon is raised at the time of loading the vehicle.

{Claim 8}

The lift-conveyor control device according to one of Claims 1 to 7, wherein

the weight estimation means estimates the weight of the vehicle based on a value of electrical current flowing in a raising and lowering motor that raises a pallet having the vehicle placed thereon from a predetermined reference position by a predetermined amount at the time of loading the vehicle.

{Claim 9}

The lift-conveyor control device according to one of Claims 1 to 8, wherein

the plurality of floors are classified into a plurality of compartments in a height direction, and a vehicle equal to or below a predetermined weight is carried to an upper compartment, whereas a vehicle over the predetermined weight is carried to a lower compartment.

{Claim 10}

A mechanical parking apparatus comprising:

a lift conveyor that is installed in a structure having a plurality of floors and goes up and down with a vehicle placed thereon;

a motor that raises and lowers the lift conveyor;

storage shelves provided on the plurality of floors along a hoistway along which the lift conveyor goes up an down; and

the lift-conveyor control device according to one of Claims 1 to 8.

{Claim 11}

A lift-conveyor control method for a mechanical parking apparatus that includes:

a lift conveyor that is installed in a structure having a

plurality of floors and goes up and down with a vehicle placed thereon;

a motor that raises and lowers the lift conveyor; and

storage shelves provided on the plurality of floors along a hoistway along which the lift conveyor goes up and down, the lift-conveyor control method comprising:

a first step of deriving a weight of the vehicle placed on the lift conveyor when loading the vehicle;

a second step of deriving an acceleration, a deceleration, and a maximum speed at which the lift conveyor is raised and lowered based on the estimated weight of the vehicle; and

a third step of controlling the motor so as to accelerate the lift conveyor, with the vehicle placed thereon and at a standstill, based on the derived acceleration and to stop the lift conveyor at a pre-specified floor by decelerating the lift conveyor based on the derived deceleration after the derived maximum speed is reached.

{Claim 12}

The lift-conveyor control device according to Claim 9, wherein

at least one of the predetermined weights is set;

the compartments are classified into at least two;

weight ranges classified according to the predetermined

weights are associated with the compartments;

pallet-determining means for, from among pallets that carry vehicles placed thereon, taking out an unoccupied pallet, which is a pallet that does not have the vehicle placed thereon, from the compartment corresponding to the weight range covering the weight of the vehicle to be loaded is provided; and

the pallet having the vehicle to be loaded placed thereon is moved to the compartment from which the unoccupied pallet has been taken out.

{Claim 13}

The lift-conveyor control device according to Claims 12, wherein

if the unoccupied pallet does not exist in the weight range covering the weight of the vehicle to be loaded, the pallet-determining means takes out the unoccupied pallet from the compartment corresponding to the weight range one rank lighter than the weight range covering the weight of the vehicle.

{Claim 14}

The lift-conveyor control device according to Claim 12 or 13, wherein

a distribution state of the weights of the vehicles is

calculated at predetermined intervals, and the vehicle weight range is set based on the distribution state.

{Claim 15}

The lift-conveyor control device according to one of Claims 12 to 14, wherein

the number of loading operations of each of the vehicles is calculated;

a corrected weight that exhibits a large value if the number of operations exceeds an average number of loading and unloading operations of all the vehicles and exhibits a small value if the number of operations is smaller than the average number of loading and unloading operations is calculated based on the vehicle, the number of operations, and the weight of the vehicle; and

the vehicle weight range is set based on the corrected weight.

{Claim 16}

The lift-conveyor control device according to one of Claims 12 to 15, wherein

a unique number of a vehicle that was loaded and unloaded in the past is associated with the weight of the vehicle; the unique number of the vehicle to be loaded is acquired when the vehicle is loaded; and if information about the weight of the

vehicle corresponding to the unique number exists, the unoccupied pallet is taken out from the compartment corresponding to the weight range covering the weight of the vehicle corresponding to the unique number.

{Claim 17}

The lift-conveyor control device according to one of Claims 12 to 16, wherein

the vehicle weight range is set for each type of vehicle.

{Claim 18}

The lift-conveyor control device according to one of Claims 12 to 17, further comprising:

calculation means for calculating the amount of energy required to load and unload the vehicle,

wherein the calculation means calculates a first amount of energy required to search for the unoccupied pallet starting from the lower floor and to place and carry the vehicle on the selected unoccupied pallet; calculates a second amount of energy required to place and carry the vehicle on the unoccupied pallet selected by the pallet-determining means; and outputs the first amount of energy and the second amount of energy.

{Claim 19}

A mechanical parking apparatus including the lift-conveyor control device according to one of Claims 12 to 18.

{Claim 20}

A mechanical parking system comprising:

the mechanical parking apparatus according to Claim 19; and

a terminal connected to the mechanical parking apparatus so that information can be received and sent.

{Claim 21}

The mechanical parking system according to Claim 20, wherein

the mechanical parking apparatus and the terminal, which are interconnected via a communication network, are disposed remotely from each other.

{Claim 22}

A mechanical parking system comprising:

a plurality of the mechanical parking apparatuses according to Claim 19,

wherein the plurality of mechanical parking apparatuses share common user data in the form of information associating the vehicle to be loaded and unloaded with the weight of the vehicle.

{Claim 23}

The mechanical parking system according to Claim 22, comprising:

the plurality of mechanical parking apparatuses; and

a terminal connected to the plurality of mechanical parking apparatuses so as to send and receive information.

{Claim 24}

The mechanical parking system according to Claim 23, wherein

the plurality of mechanical parking apparatuses and the terminal, which are interconnected via a communication network, are disposed remotely from each other.

CLAIMS:

{Claim 1}

A lift-conveyor control device of a mechanical parking apparatus that includes:

a lift conveyor that is installed in a structure having a plurality of floors and goes up and down with a vehicle placed thereon;

a motor that raises and lowers the lift conveyor; and

storage shelves provided on the plurality of floors along a hoistway along which the lift conveyor goes up and down,

the lift-conveyor control device comprising:

weight estimation means for estimating a weight of the vehicle by operating the lift conveyor at constant speed which is lower than a speed at which the lift conveyor carries the vehicle, before acceleration so as to carry the vehicle to a pre-specified floor of the plurality of floors by the lift conveyor.

{Claim 2}

The lift-conveyor control device according to Claim 1, further comprising:

storage means for storing information about vehicles stored on the storage shelves and information about the weights of the vehicle estimated by the weight estimation

means in association with each other, and

derivation means for reading out the information about the weight of the vehicle raised and lowered with the lift conveyor from the storage means and deriving the acceleration, deceleration, and maximum speed at which the lift conveyor is raised and lowered based on the read-out information.

{Claim 3}

The lift-conveyor control device according to Claim 2, wherein

when the vehicle is being unloaded, the derivation means reads out the information about the weight of the vehicle to be unloaded from the storage means and derives the acceleration, deceleration, and maximum speed at which the lift conveyor is raised and lowered based on the read-out information.

{Claim 4}

The lift-conveyor control device according to Claim 2 or 3, wherein

the derivation means derives a positive jerk and a negative jerk as well as the acceleration, deceleration, and maximum speed at which the lift conveyor is raised and lowered based on the vehicle weight estimated by the weight estimation means.

{Claim 5}

The lift-conveyor control device according to one of Claims 1 to 4 further comprising:

a motor control means for controlling the motor so as to accelerate the lift conveyor, with the vehicle placed thereon and at a standstill, after a torque based on the weight of the vehicle is produced, in the case of at least one of loading and unloading of the vehicle.

{Claim 6}

The lift-conveyor control device according to one of Claims 1 to 5, wherein

the weight estimation means estimates the weight of the vehicle based on the torque that is produced by the motor when the lift conveyor having the vehicle placed thereon is raised at the time of loading the vehicle.

{Claim 7}

The lift-conveyor control device according to one of Claims 1 to 6, wherein

the weight estimation means estimates the weight of the vehicle based on a value of electrical current flowing in a raising and lowering motor that raises a pallet having the vehicle placed thereon from a predetermined reference position

by a predetermined amount at the time of loading the vehicle.

{Claim 8}

The lift-conveyor control device according to one of Claims 1 to 7, wherein

the plurality of floors are classified into a plurality of compartments in a height direction, and a vehicle equal to or below a predetermined weight is carried to an upper compartment, whereas a vehicle over the predetermined weight is carried to a lower compartment.

{Claim 9}

A mechanical parking apparatus comprising:

a lift conveyor that is installed in a structure having a plurality of floors and goes up and down with a vehicle placed thereon;

a motor that raises and lowers the lift conveyor;

storage shelves provided on the plurality of floors along a hoistway along which the lift conveyor goes up and down; and

the lift-conveyor control device according to one of Claims 1 to 8.

{Claim 10}

A lift-conveyor control method for a mechanical parking apparatus that includes:

a lift conveyor that is installed in a structure having a plurality of floors and goes up and down with a vehicle placed thereon;

a motor that raises and lowers the lift conveyor; and

storage shelves provided on the plurality of floors along a hoistway along which the lift conveyor goes up and down, the lift-conveyor control method comprising:

a first step of estimating a weight of the vehicle by operating the lift conveyor at constant speed which is lower than a speed at which the lift conveyor carries the vehicle, before acceleration so as to carry the vehicle to a pre-specified floor of the plurality of floors by the lift conveyor.