[CLAIMS]

[Claim 1]

A load estimation apparatus comprising:

an acceleration sensor attached to at least one of a bogie body supporting wheels or a vehicle body attached to the bogie body and configured to measure a first acceleration; and

a control unit configured to estimate a load which is applied to the bogie body on the basis of load information which is acquired in advance and in which an acceleration and a load are correlated and the first acceleration~~.~~,

~~[Claim 2]~~

~~The load estimation apparatus according to claim 1,~~ wherein information corresponding to a position of the acceleration sensor and a frequency band of an acceleration which is determined on the basis of a change of the acceleration with time ~~is~~are further correlated in the load information, and

wherein the control unit is configured to further estimate the load which is applied to the bogie body on the basis of the load information and the first acceleration.

[Claim ~~3~~2]

The load estimation apparatus according to claim 1~~ or 2, wherein information corresponding to a position of the acceleration sensor is further correlated in the load information, and,~~

~~wherein the control unit is configured to further estimate the load which is applied to the bogie body on the basis of the load information and the first acceleration.~~

~~[Claim 4]~~

~~The load estimation apparatus according to claim 1,~~ wherein a frequency band of an acceleration which is determined on the basis of a change of the acceleration with time is further correlated in the load information,

wherein information corresponding to a position of the acceleration sensor is further correlated in the load information,

wherein, when the position of the acceleration sensor indicates a position on the bogie body, the frequency band is less than a natural frequency $f_{ch} \times \sqrt{2}$ where f_{ch} is a value which is determined on the basis of a spring constant of an air suspension connecting the vehicle body and the bogie body and a vehicle body mass, and

wherein, when the position of the acceleration sensor indicates a position on the vehicle body, the frequency band is equal to or greater than $f_{ch} \times \sqrt{2}$.

[Claim ~~5~~3]

The load estimation apparatus according to ~~any one of claims~~claim 1 ~~to 4,~~ or 2,

wherein a plurality of vehicle body masses are further correlated in the load information, and

wherein the control unit is configured to further acquire the vehicle body mass and is configured to further estimate the load which is applied to the bogie body on the basis of the load information, the first acceleration, and the vehicle body mass.

[Claim ~~6~~4]

The load estimation apparatus according to any one of claims 1 to ~~5,~~ 3,

wherein a plurality of positions at which a plurality of acceleration sensors are attached to at least one of the bogie body and the vehicle body are further correlated in the load information, and

wherein the control unit is configured to estimate the load which is applied to the bogie body on the basis of a plurality of accelerations which are measured by the plurality of acceleration sensors and the load information.

[Claim ~~7~~5]

The load estimation apparatus according to any one of claims 1 to ~~6~~4, further comprising a warning device,

wherein the control unit is configured to determine whether a lifespan of the bogie body is over on the basis of a sum of a preset limit load and the load which is applied to the bogie body, and

wherein the control unit is configured to transmit a signal for causing the warning device to generate a warning when it is determined that the lifespan of the bogie body is over.

[Claim ~~8~~6]

The load estimation apparatus according to any one of claims 1 to ~~7,~~ 5,

wherein the control unit is configured to estimate the load on the basis of at least an acceleration sensor that is able to measure a lateral acceleration with respect to a longitudinal direction of the vehicle body when a load which is applied from a guide rail to the bogie body is estimated, and

wherein the control unit is configured to estimate the load on the basis of at least an acceleration sensor that is able to measure a vertical acceleration with respect to the longitudinal direction of the vehicle body when a load which is applied from a road to the bogie body is estimated.

[Claim ~~9~~7]

The load estimation apparatus according to any one of claims 1 to ~~8~~6, further comprising a load detecting device that is further attached to at least one of the bogie body and the vehicle body,

wherein the load detecting device includes a load sensor that is configured to measure a second load which is applied to the bogie body and an acceleration sensor that is configured to measure a second acceleration, and

wherein the control unit adds the second load and the second acceleration to the load information.

[Claim ~~10~~8]

The load estimation apparatus according to claim 1, wherein the acceleration sensor is attached to only the vehicle body,

wherein the control unit is configured to correct the first acceleration when a frequency of the first acceleration which is acquired on the basis of a change with time of an acceleration acquired from the first acceleration is equal to or greater than $f_{ch} \times \sqrt{2}$ where a frequency f_{ch} is a value which is determined on the basis of a spring constant of an air suspension connected between the bogie body and the vehicle body and a mass of the vehicle body, and

wherein the control unit is configured to estimate the load which is applied to the bogie body on the basis of the corrected first acceleration.

[Claim ~~11~~9]

A load estimation method comprising:

a step of measuring a first acceleration using an acceleration sensor attached to at least one of a bogie body supporting wheels or a vehicle body attached to the bogie body; and

a step of estimating a load which is applied to the bogie body on the basis of load information which is acquired in advance and in which an acceleration and a load are correlated and the first acceleration~~.~~,

wherein information corresponding to a position of the acceleration sensor and a frequency band of an acceleration which is determined on the basis of a change of the acceleration with time are further correlated in the load information, and

wherein the step of estimating further includes a step of estimating the load which is applied to the bogie body on the basis of the load information and the first acceleration.

[Claim ~~12~~10]

A program causing a computer of a load estimation apparatus to perform:

a step of measuring a first acceleration using an acceleration sensor attached to at least one of a bogie body supporting wheels or a vehicle body attached to the bogie body; and

a step of estimating a load which is applied to the bogie body on the basis of load information which is acquired in advance and in which an acceleration and a load are correlated and the first acceleration~~.~~,

wherein information corresponding to a position of the acceleration sensor and a frequency band of an acceleration which is determined on the basis of a change of the acceleration with time are further correlated in the load information, and

wherein the step of estimating further includes a step of estimating the load which is applied to the bogie body on the basis of the load information and the first acceleration.