device 2 is configured as, for example, one element of an automated guideway transit (AGT) 1. For example, the automated guideway transit 1 illustrated in Fig. 1 is provided with an acceleration monitoring device 2, a plurality of vehicles 3, a plurality of wayside devices 4, and an operation management device 5.

[0014]

The operation management device 5 is a device that controls the operation of a plurality of trains including the plurality of vehicles 3, and transmits and receives a predetermined control signal to and from the vehicle 3 via the wayside device 4. For example, the wayside device 4 relays communication between the operation management device 5 and the vehicle 3.

[0015]

In the present embodiment, the vehicle 3 runs on a track T1 illustrated in Fig. 3 as an example. The track T1 includes two running lane DL1 and running lane DL2 whose running directions are determined. In addition, the track T1 is provided with a station ST1 and a station ST2. In this case, one section SEC1 is from the station ST1 to the station ST2. In addition, a region of interest RI1 and a region of interest RI2, which are regions of a part of the track T1, are defined in advance as the track T1. In the present embodiment, the region of interest is a region in

which the acceleration generated in the region of interest is to be monitored. In the example illustrated in Fig. 2, the region of interest RI1 and the region of interest RI2 are regions surrounding the expansion joint EJ1 and the expansion joint EJ2, respectively. On the track T1, relatively large acceleration is generated at a step such as an expansion joint or at a turnout position (not illustrated).

[0016]

As illustrated in Fig. 1, the vehicle 3 is provided with an on-vehicle device 31, one or a plurality of acceleration sensors 32, and a position identification information acquisition device 33. The on-vehicle device 31 is provided with a control unit 311, a storage unit 312, and a communication unit 313 as a functional configuration configured by combining hardware and software.

[0017]

In the on-vehicle device 31, the control unit 311 automatically controls a power source such as a motor, a steering device, or a boarding device (not illustrated) provided in the vehicle 3 based on a control signal received from the operation management device 5 by the communication unit 313 via the wayside device 4, and acquires the acceleration detected by the acceleration sensor 32 at a predetermined sampling cycle, stores the acceleration in

the storage unit 312, and transmits the acceleration to the operation management device 5 via the wayside device 4 by the communication unit 313 at a predetermined timing, or acquires position identification information identified by the position identification information acquisition device 33 at a predetermined sampling cycle, stores the position identification information in the storage unit 312, and transmits the position identification information to the operation management device 5 via the wayside device 4 by the communication unit 313 at predetermined timing. For example, the on-vehicle device 31 collectively transmits the time-series data of the output of the acceleration sensor 32 acquired in one section between stations and the time-series data of the output of the position identification information acquisition device 33 to the operation management device 5 via the wayside device 4 when arriving at the station. However, the transmission timing of the acceleration data and the position identification information is not limited to this case.

[0018]

For example, the acceleration sensor 32 detects acceleration of three axes and outputs the detection result to the control unit 311. The position identification information acquisition device 33 acquires information for identifying the position of the vehicle 3 and outputs the

The measurement acceleration waveform file 264 is a file that represents the measurement acceleration waveform measured by the vehicle 3 to be monitored.

[0026]

The monitoring result database 265 is information summarizing the monitoring results (or evaluation results) of acceleration values (peak values, effective values, and the like) based on newly measured measurement acceleration waveforms for each region of interest (region of interest RI1, region of interest RI2, and the like). Fig. 7 illustrates a configuration example of the monitoring result database 265. The monitoring result database 265 illustrated in Fig. 7 stores the region of interest identification code, the running lane identification code, the vehicle identification code, the measurement date and time, the acceleration sensor identification code, the measurement direction, and the monitoring result in association with each other. The region of interest identification code, the running lane identification code, the vehicle identification code, the acceleration sensor identification code, and the measurement direction are the same as each item in the reference acceleration waveform database 261. In this example, the monitoring results are a positive peak value, a negative peak value, and an effective value measured in

at an unexpected position, the position can be identified.

[0061]

<Fifth Embodiment>

An acceleration monitoring device 2b (Fig. 13) according to a fifth embodiment of the present disclosure will be described with reference to Fig. 15. Fig. 15 is a flowchart illustrating an operation example of the acceleration monitoring device 2b according to the fifth embodiment of the present disclosure. In the operation example according to the fifth embodiment illustrated in Fig. 15, the operation of the monitoring unit 24b is partially different from that in the fourth embodiment. That is, as illustrated in Fig. 15, in the fifth embodiment, the monitoring unit 24b determines whether or not the running lane is identified (step S601), and in a case where the running lane is not identified (when “NO” in step S601), evaluates the presence or absence of acceleration of the threshold value or higher (step S602). In a case where the acceleration is generated (when "YES" in step S603), the position identification unit 28 identifies the position by the position identification information (step S604), and the recording unit 29 records the position, the acceleration value, and the like in the threshold-exceeding acceleration database 267 (step S605).

[0062]

example.

[0070]

(1) The acceleration monitoring devices 2, 2a, and 2b according to a first aspect include an acquisition unit 23 that acquires the measurement acceleration waveform AWM1 which is the acceleration waveform measured by the vehicle 3 running on the track T1, the storage unit 26 that stores the reference acceleration waveforms AWB1 and AWB2 which are the acceleration waveform as a reference for the measurement acceleration waveform for the predetermined regions of interest RI1 and RI2 which are a partial region of the track, and the monitoring unit 24b that monitors the acceleration value of the non-linear expansion and contraction measurement acceleration waveforms AWM1P1c and AWM1P2c which are the acceleration waveform corresponding to the reference acceleration waveform by nonlinearly expanding and contracting the time axis of the measurement acceleration waveform. According to the present aspect and each of the following aspects, the position relating to the region of interest can be accurately identified.

[0071]

(2) The acceleration monitoring devices 2, 2a, and 2b according to a second aspect are the acceleration monitoring devices 2, 2a, and 2b according to (1), in which the acceleration value is a peak value corresponding to a

reference acceleration waveform.

[0074]

(5) The acceleration monitoring devices 2, 2a, and 2b according to a fifth aspect are the acceleration monitoring devices 2, 2a, and 2b according to (1) to (4), in which the monitoring units 24 and 24b further determine whether there is an abnormality in a first vehicle or on the track, based on a result of comparison between the acceleration value for each section of the non-linear expansion and contraction measurement acceleration waveform corresponding to the measurement acceleration waveform measured by a second vehicle and a predetermined threshold value for each section, in a case where the acceleration value for each predetermined section of the non-linear expansion and contraction measurement acceleration waveform corresponding to the measurement acceleration waveform measured by a first vehicle exceeds the threshold value for each section.

[0075]

(6) The acceleration monitoring device 2b according to a sixth aspect is the acceleration monitoring device 2b according to (1) to (4), in which the acquisition unit 23 further acquires position identification information associated with the measurement acceleration waveform, and the device further includes the position identification unit 28 that identifies a generation position of an acceleration

information, when the acceleration value of the measurement acceleration waveform exceeds a predetermined threshold value in a case where the running lane identification unit does not identify the running lane.

Industrial Applicability

[0078]

According to each aspect of the present invention, the position can be identified with high accuracy.

Reference Signs List

[0079]

1: automated guideway transit

2, 2a, 2b: acceleration monitoring device

3, 3a, 3b, 3c: vehicle

23, 23b: acquisition unit

24, 24b: monitoring unit

26: storage unit

27: running lane identification unit

28: position identification unit

29: recording unit

32: acceleration sensor

33: position identification information acquisition device

301: vehicle body

303: bogie

304: shock absorbing device

Claims

[Claim 1]

An acceleration monitoring device comprising:

an acquisition unit that acquires a measurement acceleration waveform which is an acceleration waveform measured by a vehicle running on a track;

a storage unit that stores a reference acceleration waveform which is an acceleration waveform as a reference for the measurement acceleration waveform for a predetermined region of interest which is a partial region of the track; and

a monitoring unit that monitors an acceleration value of a non-linear expansion and contraction measurement acceleration waveform which is an acceleration waveform corresponding to the reference acceleration waveform by nonlinearly expanding and contracting a time axis of the measurement acceleration waveform.

[Claim 2]

The acceleration monitoring device according to claim 1, wherein

the acceleration value is a peak value corresponding to a predetermined peak value included in the reference acceleration waveform.

[Claim 3]

The acceleration monitoring device according to claim 1 or 2, wherein

the storage unit stores a plurality of the reference acceleration waveforms for each of a plurality of running lanes on the track, and

the device further comprises

a running lane identification unit that identifies the running lane by comparing each correlation coefficient between each non-linear expansion and contraction measurement acceleration waveform which is each acceleration waveform corresponding to each reference acceleration waveform for each running lane by nonlinearly expanding and contracting the time axis of the measurement acceleration waveform, and each corresponding reference acceleration waveform, and

the monitoring unit monitors the acceleration value of the non-linear expansion and contraction measurement acceleration waveform in which the time axis of the measurement acceleration waveform is nonlinearly expanded and contracted so as to correspond to the reference acceleration waveform of the identified running lane.

[Claim 4]

The acceleration monitoring device according to claim 3, wherein

the vehicle includes a vehicle body, a bogie, and a shock absorbing device provided between the vehicle body and the bogie,

the measurement acceleration waveform includes a first measurement acceleration waveform measured by a first acceleration sensor mounted on the vehicle body and a second measurement acceleration waveform measured by a second acceleration sensor mounted on the bogie,

the reference acceleration waveform includes a first reference acceleration waveform for each running lane corresponding to the first acceleration sensor and a second reference acceleration waveform for each running lane corresponding to the second acceleration sensor, and

the running lane identification unit identifies the running lane by comparing each correlation coefficient between each non-linear expansion and contraction measurement acceleration waveform corresponding to each first reference acceleration waveform for each running lane by nonlinearly expanding and contracting a time axis of the first measurement acceleration waveform, and each corresponding first reference acceleration waveform.

[Claim 5]

The acceleration monitoring device according to any one of claims 1 to 4, wherein

the monitoring unit further determines whether there is an abnormality in a first vehicle or on the track, based on a result of comparison between the acceleration value for each section of the non-linear expansion and contraction measurement acceleration waveform corresponding to the measurement acceleration waveform measured by a second vehicle and a predetermined threshold value for each section, in a case where the acceleration value for each predetermined section of the non-linear expansion and contraction measurement acceleration waveform corresponding to the measurement acceleration waveform measured by the first vehicle exceeds the threshold value for each section.

[Claim 6]

The acceleration monitoring device according to any one of claims 1 to 4, wherein

the acquisition unit further acquires position identification information associated with the measurement acceleration waveform, and

the device further comprises

a position identification unit that identifies a generation position of an acceleration value exceeding a predetermined threshold value based on the position

identification information, in a case where the acceleration value of the measurement acceleration waveform other than the measurement acceleration waveform corresponding to the reference acceleration waveform by nonlinearly expanding and contracting the time axis exceeds the threshold value.

[Claim 7]

The acceleration monitoring device according to claim 6, wherein

the position identification information is information corresponding to a speed of the vehicle, and

the position identification unit identifies the generation position based on an integrated value of the speed with reference to a position of a nearest region of interest.

[Claim 8]

The acceleration monitoring device according to claim 3 or 4, wherein

the acquisition unit further acquires position identification information associated with the measurement acceleration waveform, and

the device further comprises

a recording unit that associates and records an acceleration value and a generation position based on the

position identification information, when the acceleration value of the measurement acceleration waveform exceeds a predetermined threshold value in a case where the running lane identification unit does not identify the running lane.

[Claim 9]

An acceleration monitoring method comprising:

a step of acquiring a measurement acceleration waveform which is an acceleration waveform measured by a vehicle running on a track; and

a step of monitoring an acceleration value of a non-linear expansion and contraction measurement acceleration waveform which is an acceleration waveform corresponding to a reference acceleration waveform which is an acceleration waveform as a reference for the measurement acceleration waveform for a predetermined region of interest which is a partial region of the track by nonlinearly expanding and contracting a time axis of the measurement acceleration waveform.

[Claim 10]

A computer-readable recording medium storing a program that causes a computer to execute:

a step of acquiring a measurement acceleration waveform which is an acceleration waveform measured by a

vehicle running on a track; and

a step of monitoring an acceleration value of a non-linear expansion and contraction measurement acceleration waveform which is an acceleration waveform corresponding to a reference acceleration waveform which is an acceleration waveform as a reference for the measurement acceleration waveform for a predetermined region of interest which is a partial region of the track by nonlinearly expanding and contracting a time axis of the measurement acceleration waveform.