受験番号:36IPE021

問1.

In recent years, the development of laminated 3D printers, which is a structuring method that involves building modeling bodies (structures) stacked in layers by using a 3D printing technology, has been progressing both domestically and internationally in the construction field. The material used for the laminated 3D printer is basically cementitious material, and mortar kneaded by a mixer is pumped and supplied to a 3D modeling machine. Construction using the laminated 3D printer can build the structures stacked in layers without any formwork and thus is expected to be highly superior to conventional concrete construction in terms of labor savings, design flexibility, safety, and the like.

[0003]

In order to put such a construction method into practical use in the future, it is necessary to consider the pumpability of the material, the self-standing properties of the material immediately after it is discharged from a nozzle to form stacked modeling bodies (structures), and the surface properties of stacked bodies after curing, in addition to the development and improvement of 3D printers.

[0004]

The building of stacked modeling bodies (structures) with high construction accuracy primarily requires the development of materials with high self-standing performance, and the machine development such as the positioning accuracy and speed of a nozzle and the ejection amount of the material. Further, it requires the structural performance that enables the built structure (structure form) to exhibit strength enough to withstand various external forces.

問2

[0037]

Each of the high-frequency inverter 12 in the power transmission section 1 and the high-frequency rectifier circuit 22 in the power receiving section 2 is composed of four reverse-conducting power semiconductor switches (Q1-Q4) such as MOSFETs or IGBTs that constitute a full bridge circuit. Specifically, it is composed of a pair of inverter legs in which high-side switching elements (Q1, Q3) and low-side switching elements (Q2, Q4) are connected in series, while a reverse parallel diode is connected in parallel to each of the switching elements. The high-frequency inverter 12 in the power transmission section 1 uses a phase-shift pulse-width modulation method that can adjust the high-frequency output only by phase control of the drive timing of the switching elements (Q1 to Q4).

[0038]

The voltage smoothing capacitor 24 connected in parallel to the battery 21 in the power receiving section 2 suppresses ripples that occur after the rectification performed by the high-frequency rectifier circuit 22 and smoothes a signal so that it is closer to direct current.

[0039]

Each of the resonant circuit 13 on the power transmission side and the resonant circuit 23 on the power receiving side is composed of a reactor (L1, L2) and a variable capacitor (C1, C2). An ultrasonic transducer using a piezoelectric material such as a BLT is a capacitor-type load (C-type load) and thus it may be combined with a reactor only to realize a resonant circuit.

[0040]

As mentioned above, BLT can be used as a powerful ultrasonic transducer because it can achieve very large stress amplitude due to the pre-compressive stress applied by bolts. In addition, BLT has high mechanical strength and high electrical/acoustic conversion efficiency. Thus, BLT is suitable for ultrasonic non-contact power transmission in the sea. Although BLT has an inherent mechanical resonant frequency, it can achieve extremely large stress amplitude by being driven at or near its resonant frequency.

問3

1. A position estimation system that estimates a position of a radio receiver in a given space based on received signal strengths when the radio receiver receives radio waves transmitted from three or more radio transmitters within the space, the position estimation system comprising:

an acquisition unit for acquiring information about the received signal strengths of the radio waves received from the three or more radio transmitter;

a generating unit for generating a first vector based on the information corresponding to at least three of the three or more radio transmitters, the first vector including, as an element, a distance between each of the at least three radio transmitters and the radio receiver; and

an estimation unit for estimating the position of the radio receiver based on similarity between the first vector and a second vector corresponding to a predetermined position in the space, the second vector including, as an element, a distance between each of the at least three radio transmitters and the predetermined position.

2. The position estimation system according to claim 1,

wherein the second vector is generated for each of a plurality of positions on a predetermined planar region in the space, and

wherein the estimation unit estimates the position of the radio receiver based on similarity between the first vector and the second vector corresponding to each of the plurality of positions.

3. The position estimation system according to claim 1 or 2,

wherein the second vector is generated for each of a plurality of different combination sets of radio transmitters, each set including at least three radio transmitters of the three or more radio transmitters,

wherein the generating unit generates the first vector for each of the plurality of sets, and

wherein the estimation unit estimates the position of the radio receiver based on similarity between the first vector and the second vector for each of the plurality of sets.