20220521

The Discovery of Twin Inaccurate Numbers

Zhi Li and Hua Li
(lizhi100678@sina.com, lihua2057@gmail.com)

Abstract:
Inaccurate numbers are characterized by the irrational square root form, which is an infinite non-repeating decimal, and the last few digits of the numerical calculation result are inaccurate. This paper finds a special kind of inaccurate numbers --- the twin inaccurate numbers, which is characterized by the fact that the sum of the two numbers is exactly equal to a rational number or a single-layer radical irrational number and the difference between the two numbers can be exactly equal to a single-layer radical irrational number. It is named twin inaccurate numbers. It is characterized in that the radicals of the two layers are all squared; the two numbers under the radicals of the second layer are dual irrational numbers.

Key words:
twin number, inaccurate number, dual irrational number

Inaccurate numbers are usually in the form of multi-layer radicals [1], which are characterized by the square root form of irrational numbers and are infinite non-recurring decimals, and the numerical calculation results are inaccurate in the last few digits. The radical form number that cannot be completely square is not a rational number. If the irrational parts of two numbers have the same sign, the sum of the numbers in this form is a rational number or the difference is a single-layer radical irrational number, which has not been reported. This paper finds a new class of inaccurate numbers, which is characterized by the fact that the sum of two such numbers is equal to a rational number or a single-layer radical irrational number, and the difference between two such numbers is equal to a single-layer radical irrational number, which is recommended to be named twin inaccurate numbers. Some examples are as follows.

1. Examples

(1)

$$\sqrt{\frac{3}{2}-\sqrt{2}}+\sqrt{\frac{3}{2}+\sqrt{2}}=2$$

(2)

$$\sqrt{\frac{15}{4}+\frac{3}{2}\cdot\sqrt{6}}+\sqrt{\frac{15}{4}-\frac{3}{2}\cdot\sqrt{6}}=3$$

(3)

$$\sqrt{\frac{29}{4}+2\cdot\sqrt{13}}+\sqrt{\frac{29}{4}-2\cdot\sqrt{13}}=4$$

(4)

$$\sqrt{12-\frac{5}{2}\sqrt{23}}+\sqrt{12+\frac{5}{2}\sqrt{23}}=5$$

(5)

$$\sqrt{\frac{69}{4}+3\cdot\sqrt{33}}+\sqrt{\frac{69}{4}-3\cdot\sqrt{33}}=6$$

(6)

$$\sqrt{\frac{95}{4}+\frac{7}{2}\cdot\sqrt{46}}+\sqrt{\frac{95}{4}-\frac{7}{2}\cdot\sqrt{46}}=7$$

(7)

$$\sqrt{29+8\cdot\sqrt{13}}+\sqrt{29-8\cdot\sqrt{13}}=8$$

(8)

$$\sqrt{\frac{159}{4}+\frac{9}{2}\cdot\sqrt{78}}+\sqrt{\frac{159}{4}-\frac{9}{2}\cdot\sqrt{78}}=9$$

(9)

$$\sqrt{\frac{197}{4}+5\cdot\sqrt{97}}+\sqrt{\frac{197}{4}-5\cdot\sqrt{97}}=10$$

(10)

$$\sqrt{\frac{7}{4}+\sqrt{3}}-\sqrt{\frac{7}{4}-\sqrt{3}}=\sqrt{3}$$

(11)

$$\sqrt{\frac{11}{4}+\frac{1}{2}\cdot\sqrt{30}}-\sqrt{\frac{11}{4}-\frac{1}{2}\cdot\sqrt{30}}=\sqrt{5}$$

(12)

$$\sqrt{\frac{15}{4}+\sqrt{14}}-\sqrt{\frac{15}{4}-\sqrt{14}}=\sqrt{7}$$

(13)

$$\sqrt{\frac{23}{4}+\sqrt{33}}-\sqrt{\frac{23}{4}-\sqrt{33}}=\sqrt{11}$$

(14)

$$\sqrt{\frac{27}{4}+\frac{1}{2}\cdot\sqrt{182}}-\sqrt{\frac{27}{4}-\frac{1}{2}\cdot\sqrt{182}}=\sqrt{13}$$

(15)

$$\sqrt{\frac{5}{4}+\frac{1}{2}\sqrt{6}}+\sqrt{\frac{5}{4}-\frac{1}{2}\sqrt{6}}=\sqrt{3}$$

(16)

$$\sqrt{\frac{11}{4}+\frac{1}{2}\cdot\sqrt{30}}+\sqrt{\frac{11}{4}-\frac{1}{2}\cdot\sqrt{30}}=\sqrt{6}$$

(17)

$$\sqrt{\frac{27}{4}+\frac{1}{2}\cdot\sqrt{182}}+\sqrt{\frac{27}{4}-\frac{1}{2}\cdot\sqrt{182}}=\sqrt{14}$$

(18)

$$\sqrt{2+\frac{1}{2}\cdot\sqrt{15}}-\sqrt{2-\frac{1}{2}\cdot\sqrt{15}}=\sqrt{3}$$

(19)

$$\sqrt{\frac{1}{3}+\frac{\sqrt{3}}{6}}+\sqrt{\frac{1}{3}-\frac{\sqrt{3}}{6}}=1$$

(20)

$$\sqrt{\frac{1}{4}+\frac{\sqrt{3}}{8}}-\sqrt{\frac{1}{4}-\frac{\sqrt{3}}{8}}=0.5$$

2. Conclusion

It is suggested that this type of numbers be named as twin inaccurate numbers. The characteristics of this type of numbers are:

(1) The two layers radical roots are all square roots, and there is no high-order root form;
(2) The two numbers under the square root of the second layer are dual single-layer irrational numbers;
(3) The sum of two twin inaccurate numbers is exactly equal to a rational number or a single-layer radical irrational number;
(4) The difference between two twin inaccurate numbers can be exactly equal to the single-layer radical irrational number.

3. Inferences

This leads to the twin inaccurate number theorems:

Theorem 1. All rational numbers can be expressed as the sum of a pair of twin inaccurate numbers.
Theorem 2. A single-layer radical irrational number can be expressed as the sum or difference of a pair of twin inaccurate numbers.
Theorem 3. The difference of a pair of twin inaccurate numbers can be expressed as the sum or difference of another pair of twin inaccurate numbers.

4. Reference

1.Zhi Li and Hua Li. Uncertainty in Multi-layer Radical Calculations and Inaccurate Numbers.https://vixra.org/abs/2201.0055