Review Article

Journal of Robotics and Automation Research

The Universal Gravitational Constant and the Earth's Permittivity

Dong-il Song

Korea Meteorological Administration, Seoul, Republic of Korea

*Corresponding author
Dong-il Song. Korea Meteorological Administration, Seoul, Republic of Korea.

Submitted: 12 Jan 2022; **Accepted:** 21 Feb 2022; **Published:** 26 Feb 2022

Citation: *Dong-il Song. (2022). The universal gravitational constant and the earth's permittivity. J Robot Auto Res, 3(1), 70-72.*

Abstract

The purpose of this study is to study the universal gravitational constant. The method investigated the relationship between the universal gravitational constant and the earth's permittivity. Earth's constituent materials are soil, etc., but the exact value of the Earth's permittivity is not yet known. It was found that the value of the universal gravitational constant and the value of the earth's permittivity were similar. As a result, it was found that the universal gravitational constant was equal to the estimate of the earth's permittivity. In conclusion, the universal gravitational constant is derived from the Earth's permittivity.

Keywords: Universal Gravitational Force, Universal Gravitational Constant, Earth's Permittivity

Introduction

Newton's formula of universal gravitation is $F=GMm/r^2$. Although Newton discovered the law of universal gravitation ($F = GMm/r^2$), he did not know the value of the universal gravitational constant. Approximately 100 years after Newton discovered the law of universal gravitation, the universal gravitational constant was measured in an experiment conducted by Henry Cavendish of England.

However, it is still not known how this universal gravitational constant emerged. In this research, it was found that the universal gravitational constant is related to the earth's permittivity and that the value of the earth's permittivity is similar to the value of the universal gravitational constant.

[permittivity of earth's constituent materials: The exact value of the Earth's permittivity is not yet known].

Henry Cavendish of England measured the universal gravitational constant (G) using a torsion balance, and Coulomb of France also measured the electric force using such a balance and developed Coulomb's constant under Coulomb's law. This indicates that the measurement principle of the universal gravitational constant (G) and Coulomb's law for Coulomb's constant (K) are equal; this proves that the universal gravitational constant (G) is related to Coulomb's law.

All objects (substances) have a permittivity holding electric charges, and if there is a temperature difference between the surface and the center of an object, electric charges are transferred between the two points due to such a temperature difference [2].

The permittivity is related to the universal gravitational constant. When a substance has a temperature difference, the electric charges move due to such a difference, and an electromotive force is generated [2]. In the case of the earth, the earth's surface is positively charged, and the center (core) is negatively charged; therefore, an electric force is generated between the positive and negative charges.

The universal gravitational constant and the earth's permittivity

A torsion balance, designed by John Michell in approximately 1750, was used by C. Coulomb to introduce Coulomb's law in 1785 (1777). In 1798, Henry Cavendish also used a balance to measure the density of the earth to assess the intensity of the gravitational force acting between two objects. He measured the universal gravitational constant (G) using a torsion balance, and Coulomb of France also used a torsion balance to measure the electric force and develop a Coulomb constant for Coulomb's law.

This indicates that the torsion balance used by Coulomb was also used in measuring the universal gravitational constant. This means that the universal gravitational constant (G) and the electric force of Coulomb's law have the same measuring criteria, which can serve as evidence that the gravitational constant (G) and the electric force of Coulomb's law are related. Substances have permittivity, an ability to hold charges, and for this permittivity, Coulomb's

constant K=8.988×10⁹ is used by applying the permittivity in a vacuum state in Coulomb's law.

To calculate the permittivity of the Earth, the relative permittivity of a substance is used compared with the permittivity of a vacuum state being set as "1". Earth's components are composed of soil, rock, sand, iron, graphite, aluminum, water, etc.The relative permittivity of Earth's constituent materials is between 4 and 80 (see Table 1).

Table 1: Permittivity and Universal Gravitational Constant of Earth's Components

Earth components	Relative permittivity	Permittivity	Coulomb constant (Electric constant)	Remark
Dry soil	4(3~5)	3.541675×10^{-11}	2.246883×10^{9}	
Sand	4(3~5)	3.541675×10^{-11}	2.246883×10^{9}	
Marble	6.4(3.5~9.3)			
Fluorspar	6.8			
Calcspar	8.3			
Aluminum	8.5			
Graphite	12.5(12~13)	11.0677×10^{-11}	0.71904×10^{9}	
Water	80			
Range	4~80	3.541675×10^{-11} ~11.0677×10^{-11}		
Earth	7.5375(estimate)	$\varepsilon g=6.67384\times10^{-11}$ ($G=6.67384\times10^{-11}$)	1.192376×10^{9}	Earth permittivity Universal gravitational constant

Due to materials such as iron and a small amount of water, the Earth's relative permittivity is estimated to be 7.5375, which is equal to the value of the universal gravitational constant.
The permittivity of earth substances ranges from 3.541675×10^{-11} to 11.0677×10^{-11}, as shown in "Table 1 Permittivity and Universal Gravitational Constant of Earth's Components."

Table 1 shows the permittivity and universal gravitational constant of Earth's components.
Since the gravitational constant $G=6.67384\times10^{-11}$ falls within the permittivity range of the Earth's components, it can be seen that the gravitational constant is derived from the Earth's permittivity.
Earth's components are composed of soil, rock, sand, iron, graphite, aluminum, water, etc. The relative permittivity of the substances (soil, rock, sand, graphite, aluminum, and water) ranges from 4 to 80.

The universal gravitational constant $G=6.67384\times10^{-11}$ is included within the range of the permittivity of the earth components (3.541675×10^{-11} to 11.0677×10^{-11}).
This signifies that the value of the gravitational constant is the average permittivity of the earth.
This indicates that the universal gravitational constant is the exact value of the permittivity of the earth.
That is, the permittivity is relevant to the electric force and is the same as the universal gravitational constant and the predicted value of the earth's permittivity, so the electric force of positive and negative charges of an object is gravitational force.
Therefore, it can be judged that the universal gravitational constant $G=6.67384\times10^{-11}$ is derived from the Earth's permittivity.

Discussion

The universal gravitational constant is derived from the Earth's permittivity.
The gravitational force of a celestial body arises from the temperature difference of the celestial body.
Earth and other celestial bodies of different constituent materials have different permittivities.
Therefore, the universal gravitational constant of celestial bodies needs to be reviewed.
In other words, since the gravitational force of a celestial body occurs inside the celestial body, it is necessary to review whether the use of the formula for gravitational force "$F=GMm/r^2$" is appropriate.

Conclusion

The gravitational constant is equal to the predicted value of the Earth's permittivity.
Since the Earth's permittivity is not yet known, the predicted value of the Earth's permittivity is the Earth's permittivity value.
Therefore, the predicted value of the Earth's permittivity is equal to the value of the universal gravitational constant.

Data Availability

Data supporting the findings of this manuscript are available from the corresponding author upon reasonable request.
Further documentation about data processing is available at Electromotive Force Generated in All Materials under Temperature Difference, 3-4. https://doi.org/10.21203.re.3.rs-1137728/v2

Code Availability

Custom codes that support the findings of this study are available at a dedicated Github repository (https://github.com/DongilSong/UniversalGravitationalConstant) Received: 17 January 2022.

References

1. Seebeck effect https://en.wikipedia.org/wiki/Thermoelectric_effect#Seebeck_effect Accessed on 8 September 2021.
2. Song, D. I. (2021). Electromotive Force Generated in All Materials under Temperature Difference.