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Author: Mr. Shubham Das
R V College of Engineering, Bengaluru, India, shubhamdastwo@gmail.com

Mr. Adarsh chandra
R.V.College of Engineering, India, adarshchandra.cv19@rvce.edu.in
Mr. SHIKHAR SAXENA
R V College of Engineering, Bengaluru, India, saxena.shikhar9457977570@gmail.com

DEVELOPMENT OF MICROGRAVITY SIMULATOR AND ITS WORKING ALGORITHM

Abstract

Microgravity, or zero gravity, refers to the condition in which the gravitational force on an object is zero or nearly zero. This condition can be observed in space, where objects float freely due to the absence of gravity. Microgravity has numerous effects on physical and biological systems, including changes in fluid behavior, muscle atrophy, and changes in bone density. Therefore, studying the effects of microgravity on these systems is of great importance for space exploration, as well as for understanding human physiology. To conduct these studies, a microgravity simulator is required. They are crucial tools for studying the effects of microgravity on physical and biological systems. In this paper, a design for such a microgravity simulator is described along with its working algorithm. The Microgravity simulator as designed is based on the already developed Clinostat models, which have 1D, 2D or 3D rotation as specified for the terms of their usage. The simulator structure developed by us consist of a base frame, upon which the entire structure is sustained, the outer frame which will be rotating in two directions and the inner frame which is basically the incubator which holds the payload inside it. The frame's speed and rotation are controlled by the stepper motors which are located outside of the structure. The stepper motor and the accelerometers present works on an algorithm developed, which controls the entire working of the simulator. They nullify the gravity vector by making the frames rotate very fast, which changes the impact of gravity acting on a particular point. The entire model is based on random walk algorithm which describes a path that consists of a succession of random steps on some mathematical space. This algorithm forms the basis of the numerical calculation for the microgravity simulator being developed. After the completion of the structure, the payload being developed will be placed inside the incubator, which will be tested to various rpm. The payload is a bacteria, whose growth curve rates will be checked when subjected over time to the conditions simulated. With the use of the simulator being developed, experiments can be conducted on bacteria's and microorganisms and gather data about their growth and behavior in microgravity conditions enabling us to better understand the effects of microgravity on our bodies and the environment.