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ELECTRODYNAMIC CENTRIFUGE FOR SPACE HABITATS WITH ARTIFICIAL GRAVITY

Abstract

Rotation is in the focus of all artificial-gravity research as generated centripetal acceleration can be substitute for gravity.

Electrodynamic centrifuge is axial thrust rotation generator designed to be included into larger space structures. General theory of moments for electrodynamic magnetic levitation systems based upon the dynamic circuit principles and emphasized on loop-shaped coils and figure-eight-shaped null-flux coils suspension applied in Maglev EDS trains can be modified and fully applied to spin objects in favorable space environment of cold vacuum without gravity. It is characterized by very low magnetic drag at low speed, high suspension stiffness, high lift to drag ratio and high guidance to drag ratio. Generation of controlled magnetic forces and rotating magnetic fields between rotating modules and guideway will obtain controllable and contactless rotation.

Eletrodynamic centrifuge contains guideway and two expandable habitat modules connected with docking module. Gravity generation is gradual. Cylindrical habitats are radially oriented with respect to the axis of rotation and can be combined with axially orientated habitats. Electrodynamic centrifuge is high-precision, low-speed, and self-aligning system. Any variation from stable position will push and pull rotating modules back to designed optimal position without active electronic stabilization. Guidance subsystem enables radial and axial centerings. Spin rate, spin-up and spin-off are achievable by change of current frequencies. Rotation is uniformed, contactless and loss-less while vibration, wobble, and shaking are significantly reduced. Hybrid power supply system consists of: solar panels, fuel cells, rechargeable batteries, converters, and inverters.

Two electrodynamic centrifuges can be included into coaxial set to spin in opposite directions to cancel angular momentums. Electrodynamic centrifuge set can be independent or fully incorporated into a space station or a spaceship. Another available configuration conists of two identical counter-rotating electrodynamic centrifuges with parallel axes of rotation in order to be amplified by multiplying the same configuration along the axes to obtain larger and more complex counter-rotating cylinder-shaped habitat structures with highly increased over-all capacities for human settlements.

3D printers and 3D printing autonomous robots will liberate missions from the launch constraints and enable additive manufacturing, and assembly of large and complex structures in LEO. Needed materials are to be advanced, lightweight, high strength, reliable, computationally designed for extreme environments.

Habitats with variable gravity could determine effects of living in lunar and Martian conditions. The final goal is to establish human settlements in space.