Abstract #755

English

PROSPECTS FOR A SELF-REPLICATION INFRASTRUCTURE ON THE MOON USING IN-SITU RESOURCES & 3D PRINTING TECHNOLOGY

Recent developments in 3D printing technology have opened up the possibility of creating self-replicating machines, a concept that was proposed almost 40 years ago for the development of a lunar infrastructure. In conjunction with a judicious choice of selected in-situ raw materials, I present an architecture that emphasises material closure whilst exploiting the capabilities of 3D printing. Indeed, I suggest that 3D printing provides the capacity for universal construction. Critical to the universal constructor, and indeed, the architecture presented, is the capacity for 3D printing electric motors and their associated electronics and sensors. This corroborates theoretical studies of kinematic self-replicators which require the ability to manipulate the environment. This is the primary focus of this presentation/paper. My group has been attempting a number of 3D printable motor designs manufacturable from lunar resources, including some experimental prototypes. With regard to electronics, we suggest that vacuum tube technology offers better prospects for 3D printability using lunar resources than solid state technology – indeed, vacuum tube-derived multi-functionality aids in product closure necessary for self-replication. We have been exploring the use of such 3D printable electronic components to create simple rover controllers based on hardware neural network circuits for fault-tolerance. Recurrent neural networks offer the property of Turing-completeness whilst exploiting the hardware-on-demand capacity of 3D printing. A simple two neuron hardware circuit on a desktop rover has been demonstrated to implement obstacle avoidance. In addition, we have demonstrated on our Kapvik micro-rover, the ability to extract regolith physical properties for rover-based surveying through the use of simple sensors with neural networks. My conclusion is that if we can demonstrate that we can manufacture a complete electric motor system from raw resources, we have demonstrated universal construction.

French

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