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Design of maximum power density of TVC driving motor for space launch vehicle considering space environment

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The most important point in electromagnetic design for the drive motor design of an electric TVC(Thrust vector control) system for space launch vehicle is the right choice of the maximum allowable current density considering the heat transfer condition of the vacuum environment and light weight design through high output density design. Thermal-electromagnetic interaction analysis considering the heat transfer conditions of the system's environment is performed, where the heat flow between the system components is determined by the specific heat and the heat transfer coefficient. In the heat transfer method, the heat transfer coefficient is determined by the kind and area of the material and the temperature difference in case of conduction and radiation, but in the case of convection condition, the conduction coefficient changes according to the pressure. The thermal conductivity coefficient was calculated considering the operating environment of the system in the stratosphere, and the maximum allowable current density of the TVC system could be calculated through this calculation. The output density is usually expressed as a volume-to-volume output, which is a criterion for how efficiently a motor can produce large forces. In the situation where the allowable voltage and the limit drive speed are determined, the achievement of the maximum output density can be achieved through the electromagnetic improvement design. An analysis of how much TRV(Torque per unit rotor volume) has been increased compared to the existing design through the application of various latest high power density design techniques.

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