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BRAKING PERFORMANCE STUDY FOR EDDY BRAKE DETUMBLING SPACE DEBRIS OBJECTS

Abstract

Active debris removal and orbital servicing are attracting increasing interest owing to their temporal requirements. In order to safely manipulate a tumbling target, the target object should be detumbled before any operations can be done. A contactless detumbling method based on eddy currents induced by an external electromagnetic coil ("Eddy Brake") has been recommended to be a feasible approach for space debris removal. Therefore, we investigate the braking performance of this "Eddy Brake" in the on-going research.

First, by applying the Magnetic Tensor Theory, an approximate eddy current torque model for a polyhedron target object is derived. Then, the approximate analytical model is revised through high accuracy finite element model of the target object. Secondly, braking performance for detumbling debris objects which are rotating at high speeds are analyzed through numerical experiments. Computed results indicate that the braking capability can be improved considerably by adopting high temperature superconducting coils. Furthermore, the superconducting coils are capable of dutumbling rotations up to 720deg/s combined with nutational motion.