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Stabilization of an underactuated satellite model with magnetorquers by oscillating controls

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We consider the mathematical model of a low orbit satellite with electromagnetic actuation described in the recent paper [R.Misra,R.Wisniewski, A.Z. "Attitude Stabilization of a Satellite having only Electromagnetic Actuation using Oscillating Controls", Aerospace (submitted)]. This model is not fully actuated as the control torque is proportional to the vector product of the geomagnetic field and the field generated by magnetorquers. The case of periodic time varying geomagnetic field has been previously studied by several authors. We focus here on the case of constant geomagnetic field, which corresponds to an equatorial orbit and brings significant theoretical challenges for control design. A family of time periodic feedback controllers is proposed to stabilize the equilibrium of this model. We discuss the convergence rate of the closed-loop system and illustrate the resulting dynamics with numerical simulations.

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