On the stability conditions for a heavy gyrostat

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SUMMARY

A gyrostat $\mathcal{G}$ is a mechanical system made of a rigid body $\mathcal{P}$ called the *platform* and other bodies $\mathcal{R}$ called the *rotors*, connected to the platform in such a way that the motion of the rotors does not modify the distribution of mass of the gyrostat $\mathcal{G}$.

In this communication, we will focus on the stability of somne permanent rotations of a heavy gyrostat with a fixed point, that is to say when the gyrostat is under a uniform gravity field. For this case, both necessary and sufficient conditions of stability have been obtained by means of different methods, mainly by using appropriate Lyapunov functions [1, 2, 3, 5]. Provided the system can be regarded as a Lie-Poison one, these results can be obtained and extended by means of the Energy-Casimir method [4]. In this way, we give the stability conditions in terms of the moments of inertia of the gyrostat, the position of the center of mass, as well as in terms of the angular momentum and two gyrostatic moments. Moreover, the necessary conditions are also sufficient, for some configurations of the gyrostat.

Keywords: gyrostat rotation, stability, EnergyCasimir method

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