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Jumping of a Spinning Spheroid

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As is well known, a hard-boiled egg will rise from the horizontal to the vertical if it is spun sufficiently rapidly on a table with its axis of symmetry initially horizontal. We consider here the problem of a spinning spheroid, and show that in certain circumstances the spheroid may lose contact with the table in the course of this rising motion. Allowing for slip and weak friction at the point of contact, the dynamical equations for a uniform spheroid, are treated by the multiple-scale perturbation method to resolve the two time-scales intrinsic to the dynamics. An approximate solution for the high frequency component of the motion shows a growing oscillation of the normal reaction, and predicts the circumstances in which this can fall to zero (leading to jumping of the body). The exact solution for the free motion after jumping and until contact with the table is reestablished. The analytical results agree well with numerical simulations of the exact equations.

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