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Data analysis for the chaotic waterwheel GEORGE RUTHERFORD, BENJAMIN ROGERS[1], RICHARD MARTIN, Illinois State University — The Malkus waterwheel is a simple mechanical system whose behavior is approximated by the Lorenz equations. The ISU waterwheel consists of a circular disk on which are mounted 36 cylindrical cells. The wheel is tilted, and water enters the cells symmetrically at the top of the wheel. Each cell has a hole in the bottom to allow water to escape, and friction is provided by inductive braking. The wheel can exhibit quasi-uniform rotation, periodic reversals, and chaotic reversals. The experimental data from our laboratory show good agreement with numerical simulations of the idealized model equations, although some significant differences remain. For example, at large values of the brake strength, the simulations show periodic motion, while the experimental data appear chaotic. This poster will describe the use of the 0-1 test for chaos to determine the nature (periodic or chaotic) for data over a range of brake strength values. This analysis contends that the experimental data at large damping values is indeed chaotic, in opposition to the numerical simulation prediction. We also report preliminary results of a novel method for determining the location of fixed points from the phase portraits of the experimental data.

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