The Water Wheel: An Exploration of Deterministic Chaos

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A chaotic water wheel is a special kind of mill wheel where the paddles have holes in the bottom so that they are leaking. If a water support is installed at the top, the top paddles where filled with water and the wheel starts rotating. Depending on the intake flow the rotation can be in a chaotic state or not. To investigate this interesting phenomenon some water wheels were build. To determine the dependencies of the parameter of the wheel, like intake flow or friction, a physical model was created and used for simulation. With this simulation it was possible to understand the meaning and influence of the wheel parameters and transfer this knowledge to a real water wheel. Exact measurement of the parameters of the water wheel were taken to adapt the setting of the simulation. With this model it was possible to reproduce the measured movement patterns with the simulation in a quantitative matter. In some parts it was possible to reproduce the movement pattern even qualitative which is quite complicate in chaotic systems. With the knowledge that the simulation can specify the movement of the wheel it was possible to ultimately not only simulate a build water wheel but also to calculate parameters for new water wheels with specific requirements.

Awards Won:
Fourth Award of $500