Appendix 1: the overall experiment setup

A desk with several camera equipment

AI-generated content may be incorrect.

Figure 1 Experiment setup.

The experimental setup comprises a simulated plant and a physically instantiated reservoir integrated into a closed-loop system. The plant is implemented in MATLAB Simulink and displayed on the vertical monitor. The physical reservoir is mounted on an aluminum frame and actuated by a pair of servo motors, which provide input signals to the reservoir. An optical tracking system with four cameras captures the reservoir's state, serving as the output. A set of computers manages the plant simulation and facilitates real-time signal exchange between the plant and the reservoir. Figure 3a in the main text presents a front view of the setup, which is also the perspective used in all experimental videos.

Appendix 2: system mathematical matrices

The matrices in Equation 5 in the main text are:

The matrices in Equation 12 in the main text are:

where denotes the proportional gain of the PID controller applied when the servo motors are actuated to satisfy Equation 6. The term does not influence system stability and is therefore omitted from the expression above.

Exact values for all matrices involved can be obtained by running the script “pd\_model.m” provided in the shared code repository. This information is intended to support the experimental replication.