

Real-time synchronization feedbacks for single-atom frequency standards

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Simple feedback loops, inspired from extremum-seeking, are proposed to lock a probe frequency to the transition frequency of a single quantum system following quantum Monte-Carlo trajectories. The quantum system, in study, corresponds to a 3-level one that appears in coherence population trapping and optical pumping. For this systems, the feedback algorithm is shown to be convergent in the following sense: the probe frequency converges in average towards the system-transition one and its standard deviation can be made arbitrarily small. Closed-loop simulations illustrate robustness versus jump-detection efficiency and modeling errors.