

Starting Strong: Optimization Techniques for Physical Reservoir Computing

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Physical reservoir computing exploits complex dynamical substrates for information processing, but identifying configurations that maximize computational capacity remains a key challenge. We consider the optimization of physical reservoir computers using task-independent measures of computational capability, rather than relying exclusively on benchmark performance, which may be difficult to interpret and can bias design toward specific tasks. Such measures capture complementary aspects of reservoir behavior, including separability, robustness, and temporal information processing, with the preferred balance determined by the target application. We examine this optimization problem in the context of magnetic skyrmions, localized whirl-like magnetic textures with nontrivial topology, whose nonlinear dynamics and rich configurational degrees of freedom make them a promising platform for physical reservoir computing. We further consider the search for suitable operating points within substrate-dependent and physically admissible parameter spaces, where optimization must respect experimental constraints while balancing generic and task-specific performance. Together, these ideas provide a systematic framework for engineering physical reservoirs with computational properties tailored to application requirements.