



Iranian Journal of Physics Research, Vol. 25, No. 2, 2025
DOI: 10.47176/ijpr.25.2.22056

Study of mechanical memory and the role of interactions between memory elements

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(Received 4 February 2025; in final form 5 May 2025)

Abstract

Memory behavior in certain disordered mechanical systems is investigated through the analysis of the behavior of a collection of identifiable memory elements called hysterons. We begin by introducing a simple elastic buckling rod as the simplest memory element (hysteron). The hysteron is a two-state element capable of transitioning between its internal states in response to an external force. These transitions depend not only on the instantaneous magnitude of the applied force but also on the history of previous forces. A system composed of two hysterons allows us to study the role of interactions between hysterons in shaping the memory behavior of more realistic systems. Apart from potential reciprocal interactions, non-reciprocal interactions are also examined. Hysteron transitions show an unprecedented variety and complexity; this is crucial for understanding memory in real materials and for designing new metamaterials with the desired behaviors.

Keywords: Mechanical systems, Memory, Hysteron, Transition graph, Non-reciprocal interaction

For full article, refer to the Persian section