

OPTIMIZATION OF MECHANICAL LOGIC SYSTEMS

Brianna MacNider, Kenny Swartz, Mike Tupek, Katie Riley, Dan Tortorelli, Brandon Talamini

Lawrence Livermore National Laboratory

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Abstract

There is a great deal of interest in mechanical computing as an alternative to traditional electronic computing for applications in which electronics are expected to have degraded performance, due to either environmental factors or time of operation requirements. Mechanical bistability can be leveraged to implement digital logic in such systems, but this leaves the problem of how to design and implement logic operations between bistable 'bits'. Hand-designed mechanical logic gates can exhibit high complexity, as well as small and fragile flexures which can be prone to plasticity and fracture. In addition, the propagation of signals through a mechanical circuit is prone to energy loss and requires careful tuning. Here, we show the implementation of an inverse design optimization approach to automate the process of designing mechanical logic gates. We also examine the behavior of multiple connected mechanical bits and logic gates with an eye toward optimizing system-level mechanical 'circuits'.

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