

**CRUNCH Seminars at Brown, Division of Applied Mathematics**

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**Integrating Physics-Based Modeling with Machine Learning:  
A Survey**

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**There is a growing consensus that solutions to complex science and engineering problems require novel methodologies that are able to integrate traditional physics-based modeling approaches with state-of-the-art machine learning (ML) techniques. This paper provides a structured overview of such techniques. Application areas for which these approaches have been applied are summarized, then classes of methodologies used to construct physics-guided ML models and hybrid physics-ML frameworks are described. We then provide a taxonomy of these existing techniques, which uncovers knowledge gaps and potential crossovers of methods between disciplines that can serve as ideas for future research.**