

**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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In this manuscript, we provide a structured and comprehensive overview of techniques to integrate machine learning with physics-based modeling. First, we provide a summary of application areas for which these approaches have been applied. Then, we describe classes of methodologies used to construct physics-guided machine learning models and hybrid physics-machine learning frameworks from a machine learning standpoint. With this foundation, we then provide a systematic organization of these existing techniques and discuss ideas for future research.