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Learning fluid flow physics from noisy, incomplete, experimental data[1] LOGAN KAGEORGE, PATRICK REINBOLD, MICHAEL SCHATZ, ROMAN GRIGORIEV, Georgia Institute of Technology — Purely data-driven methods have shown a lot of promise in identifying models of simple, low-dimensional systems from data which have a low level of noise and provide a complete description of the system state. However, they fall apart for data that is high-dimensional, noisy, or incomplete, which is common in fluid dynamics. We show that this challenge can be addressed by augmenting the data-driven approach with a few general physical constraints and using a weak formulation of the model. To illustrate this, we construct a quantitative two-dimensional model of a weakly turbulent flow in a thin layer of electrolyte driven by Lorentz force from PIV data on a coarse spatiotemporal grid. Our hybrid approach also allows reconstruction of the latent variables that cannot be measured directly, e.g., pressure and forcing field.

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