

Using ℓ_1 Regularization to Improve Numerical Partial Differential Equation Solvers

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Sparse regularization plays a central role in many recent developments in imaging and other related fields. However, it is still of limited use in numerical solvers for partial differential equations (PDEs). This talk investigates the use of ℓ_1 regularization to promote sparsity in the shock locations of hyperbolic PDEs. We develop an algorithm that uses a high order sparsifying transform which enables us to effectively resolve shocks while still maintaining stability. Our method does not require a shock tracking procedure nor any prior information about the number of shock locations. It is efficiently implemented using the alternating direction method of multipliers. We present our results on one and two dimensional examples using both finite difference and spectral methods as underlying PDE solvers.