# Compressive Sensing of PDE-Constrained Signals

## Theory, Algorithms and Applications of applying Compressd Sensing on Spatiotemporal Sourcess governed by PDE

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**Abstract**

Many natural world environmental signals are *spatiotemporal sources*, where the signal depends on spatial location and changes over the time, e.g. temperature of a piece of land or an electromagnetic field. *Diffusion fields* are an important subclass of such sources, where the source field satisfies *diffusion partial differential equation (PDE). Sensor networks* have been used as typical type of sampling devices to measure and reconstruct such sources for monitoring or automation purposes. Despite many benefits, sensor networks have their own deficiencies. First, there is a limit on the number of sensing units that can be deployed which limits the spatial sensing resolution. Moreover, battery life of a sensor node limits the power consumption and the temporal sampling rate. In this talk, the above limitations are tackled by means of compressed sensing (CS).

In the first part of the talk, we will see how we can take advantage of the instinct property of such sources, i.e. satisfying a PDE, as side information to increase efficiency. We demonstrate why diffusive compressed sensing (DCS) outperforms classic CS by treating PDE as a second source of knowledge in addition to sparsity. Experimental results are provided in the second part of the talk to demonstrate the usefulness of the proposed method. We will see that DCS improve the reconstruction results by incorporating the side information from diffusion PDE into CS recovery. Furthermore, we will see that DCS results in substantial data savings while producing estimates of higher accuracy, as compared to CS-base estimates.