

# **An Economical Representation of PDE Solution by using Compressive Sensing Approach**

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## **ABSTRACT**

We introduce a redundant basis for numerical solution to the Poisson equation and find a sparse solution to the PDE by using a compressive sensing approach. That is, we refine a partition of the underlying domain of the PDE several times and use the multi-level nested spline subspaces over these refinements to express the solution of the PDE redundantly. We then use a compressive sensing algorithm to find an economical representation of the spline approximation of the PDE solution. The number of nonzero coefficients of an economical representation is less than the number of the standard spline representation over the last refined partition, i.e. finite element solution while we will show that the error of the spline approximation with an economical representation is the same to the standard FEM solution. This approach will be useful, e.g. in the situation when the PDE solver has a much powerful computer than the users of the solution.