Title: Finite Element Methods and its Applications Speaker: Cuiyu He

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Abstract: The finite element method (FEM) has been a leading numerical method to solve partial differential equations (PDEs). This colloquium talk will briefly introduce the FEM and its numerical analysis in several applications. The FEM will be briefly introduced in the first section. In the second section, I will focus on applying the method to adaptive mesh refinement procedures (AMR). A posteriori error estimation for the finite element method plays a critical role in the AMR procedure. In the third section, I will then illustrate unfitted finite element methods and their application in shape optimization. The shape optimization analysis is performed on a severely ill-posed Bernoulli free boundary problem. The last section will introduce the deep neural network (DNN) as an extension of the adaptive FEM. I will also include several of my works using DNNs to solve PDEs. This talk is mostly comprehensible for graduate students.