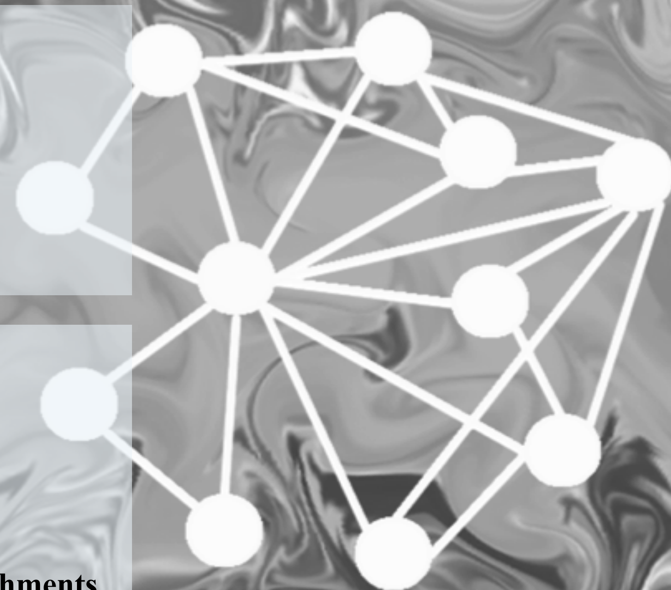
ACMS Applied Math Seminar

Dr. Jue Yan
Iowa University

Thursday, October 14, 2021
3:30 pm – 4:30 pm



Zoom Link:
https://notredame.zoom.us/j/92916473192?pwd=Z0VWZE03dW45SXJ5NWdGcEhCaHpkUT09

Meeting ID: 929 1647 3192
Passcode: CMP61K
This talk will also be held in 101A Crowley Hall, refreshments will be provided.

Cell-average Based Neural Network Method for Partial Differential Equations

Motivated by finite volume scheme, a cell-average based neural network (CANN) method is proposed. The method is based on the integral or weak formulation of partial differential equations. A simple feed forward network is forced to learn the solution average evolution between two neighboring time steps. Offline supervised training is carried out to obtain the optimal network parameter set, which uniquely defines one finite volume like neural network method. Once well trained, the network method is implemented as a finite volume scheme, thus is mesh dependent. Different to traditional numerical methods, our method can be relieved from the explicit scheme CFL restriction and can adapt to any time step size for solution evolution. For Heat equation, first order of convergence is observed and the errors are observed independent of the mesh size in time. The cell-average based neural network method can sharply evolve contact discontinuity with almost zero numerical diffusion. Shock and rarefaction waves are well captured for nonlinear hyperbolic conservation laws. The CANN method is further applied to solve high order dispersive and biharmonic PDEs. Again, cell-average based neural network method can adapt large time step size for solution evolution even being implemented as an explicit method.