Course instructor: B. Shanker, bshanker@egr.msu.edu
Date/time: Tuesday/Thursday, 1:00-2:20 p.m. in 004 Urban Plan & Land Arch
Prerequisites: Numerical Linear Algebra

Note: This course is open to both advanced undergraduate and graduate students

Course description: In multiple areas in engineering and physics, the evaluation of pair potentials plays a key role. Some examples of these are Coulomb, Yukawa, Helmholtz and Stokes. The associated computational cost (both CPU and memory) scales as \(O(N^2)\), which is prohibitive when as \(N\) increases or when one needs repeated evaluations (as in MD) or both. This course will develop techniques (both math and algorithm) that can be used to ameliorate this cost such that it scales as \(O(N\ln^d N)\). To this end, the students will learn the following:

1. Fourier based techniques
2. Methods that exploit rank deficiency (ID, ACA,H-Matrices)
3. Fast multipole methods for
   a. Laplace systems
   b. Extensions to non-oscillatory potentials
   c. Helmholtz systems
4. Methods for transient analysis

Please contact the course instructor if you have any questions or require an override into the course