1056-65-454 **Guohui Song*** (gsong3@iit.edu), Department of Applied Mathematics, Illinois Institute of Technology, 10 West 32nd Street, Chicago, IL 60616, and **Yuesheng Xu**, Department of Mathematics, Syracuse University, Syracuse, NY 13244. *Approximation of kernel matrices with multilevel circulant matrices.*

Kernel-based methods have gained popularity in a variety of fields such as approximation, interpolation, meshless methods, neural networks and machine learning. A common problem of these kernel-based methods is to calculate the inverses of the matrices generated by a kernel function and a set of points. However, the computational cost of calculating the inverses of kernel matrices is a major concern. This work focuses on developing fast algorithms for calculating the inverses by approximating the kernel matrices with related multilevel circulant matrices so that the fast Fourier transform can apply to reduce the computational cost of calculating the inverses to $O(n\log(n))$, where n is the size of the matrix. Convergence analysis of the approximation method is established and numerical examples are presented to demonstrate the approximation accuracy and computational efficiency. (Received September 08, 2009)