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ITERATIVE SINC-CONVOLUTION METHOD FOR SOLVING RADIOSITY EQUATION IN COMPUTER GRAPHICS*

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Abstract. A new and efficient sinc-convolution algorithm is introduced for the numerical solution of the radiosity equation. This equation has many applications including the production of photorealistic images. The method of sinc-convolution is based on using collocation to replace multi-dimensional convolution-type integrals—such as two dimensional radiosity integral equations—by a system of algebraic equations. The developed algorithm solves for the illumination of a surface or a set of surfaces when both reflectivity and emissivity of those surfaces are known. It separates the radiosity equation's variables to approximate its solution. The separation of variables allows the elimination of the formulation of huge full matrices and therefore reduces required storage, as well as computational complexity, as compared with classical approaches. Also, the highly singular nature of the kernel, which results in great difficulties using classical numerical methods, poses absolutely no difficulties using sinc-convolution. In addition, the new algorithm can be readily adapted for parallel computation for an even faster computational speed. The results show that the developed algorithm clearly reveals the color bleeding phenomenon which is a natural phenomenon not revealed by many other methods. These advantages should make real-time photorealistic image production feasible.

Key words. radiosity, sinc, sinc-convolution, photorealistic, computer graphics

AMS subject classifications. 68U05, 65D18, 65D30

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