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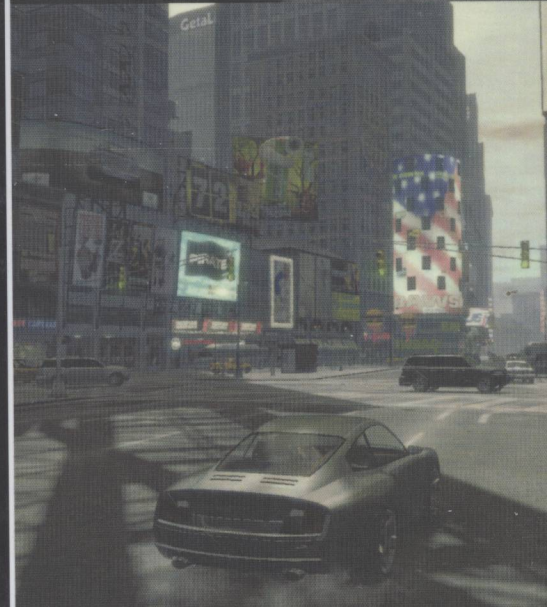
SHADERX⁷

Advanced Rendering Techniques

*Edited by
Wolfgang Engel*



SHADERX SERIES



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SHADERX⁷: ADVANCED RENDERING TECHNIQUES

WOLFGANG ENGEL

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**ShaderX⁷: Advanced Rendering
Techniques**
Wolfgang Engel

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To my wife Katja and my daughters Anna, Emma, and Lena
—Wolfgang



Acknowledgments

The talented editors and contributors of this book spent eight months writing, selecting, editing, and finalizing the articles for the newest volume of the best-selling *ShaderX* series. We hope you find these state-of-the-art graphics-programming articles useful in your own work. As with all the other *ShaderX* books, the topics here cover ready-to-use ideas and procedures that can solve many of your daily graphics-programming challenges.

I would like to thank the section editors for the fantastic job they did. The work of Kenneth Hurley, Wessam Bahnassi, Sebastien St. Laurent, Natalya Tatarchuk, Carsten Dachsbacher, Matthias Wloka, Christopher Oat, and Sam Martin ensures that the quality of the series stands up to the expectations of our readers.

The great cover screenshots were taken from GTA IV. I want to thank Sam Hauser for allowing us to use those shots. I am especially proud of those shots because this is the second game from Rockstar that I contributed to. Those shots are also used to illustrate a shadowing technique covered in the article “Facetted Shadow Mapping for Large Dynamic Game Environments” by Ray Tran.

The team at Charles River Media made the whole project happen. I want to thank Emi Smith, Jennifer Blaney, and the whole production team, who took the articles and made them into a book.

Special thanks go out to our families and friends, who spent many evenings and weekends during the long book production cycle without us.

I hope you have as much fun reading the book as we had creating it.

Wolfgang Engel

P.S: Plans for an upcoming *ShaderX*⁸ are already in progress. Any comments, proposals, and suggestions are highly welcome (wolf@shaderx.com).



About the Section Editors

Wessam Bahnassi's professional career began about eight years ago, when he started the development of the DirectSkeleton real-time 3D engine and its pipeline tools for In|Framez. He led the development team for several games and real-time demos based on the same engine, in addition to his many contributions and publications in graphics and programming in general. Wessam has been a Microsoft Most Valuable Professional (MVP) for DirectX technologies for four years. Currently, he works at Electronic Arts in Montreal, doing console and PC graphics and game programming for some of EA's great titles.

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Wolfgang Engel works in Rockstar's core technology group as the lead graphics programmer. He is the editor of the *ShaderX* books, is the author of several other books, and loves to talk about graphics programming. He has been an MVP DirectX since July 2006 and is active in several advisory boards in the industry.

Kenneth Hurley has worked for game and technology companies such as Electronic Arts and Intel, and most recently was a senior engineer at NVIDIA Corporation. While there, he participated in the areas of Xbox hardware and numerous video games including *Tiger Woods Golf*. Kenneth has been a consultant for several Silicon Valley companies and has worked with the United States government on military equipment, including the highly acclaimed Land Warrior. Kenneth's passion for and more than 20 years of experience in the gaming industry is what has brought him to the helm of Signature Devices, his second start-up as an independent developer. He has contributed to best-selling computer books on 3D graphics and is a requested speaker at conventions and workshops around the country. Kenneth received his BS degree in computer science from the University of Maryland.

Sam Martin is the lead programmer of Enlighten at Geomerics. There, he fell in love with lighting as he nurtured their real-time radiosity SDK from its conception. In a previous relationship with computational geometry, he developed the navigation system behind Lionhead's *Black & White 2*, a tale he may put on paper someday. There was also a fling with Lionhead's early core tech team, and he hasn't forgotten the good times he had with Intrepid and Kuju London. His relationship with patterns and algorithms is going strong, but the temptations of drumming in samba bands and Cambridge beers have been known to lead him astray.

Christopher Oat is a member of AMD's game computing applications group, where he is a technical lead working on state-of-the-art demos. In this role, he focuses on the development of cutting-edge rendering techniques for the latest graphics platforms. Christopher has published his work in various books and journals and has presented work at graphics and game developer conferences around the world. Many of the projects Christopher has worked on may be found at www.chrisoat.com.

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He contributed several game-development-related articles to *ShaderX*³ and *ShaderX*⁴. He received the IEEE Transactions on Multimedia 2005 Prize Paper Award for his paper titled “The Plenoptic Illumination Function” (published in IEEE Trans. on Multimedia, Vol. 4, Issue 3, September, 2002). Since 2000, he has provided programming consultancy services to Development Bank of Singapore (Hong Kong).

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