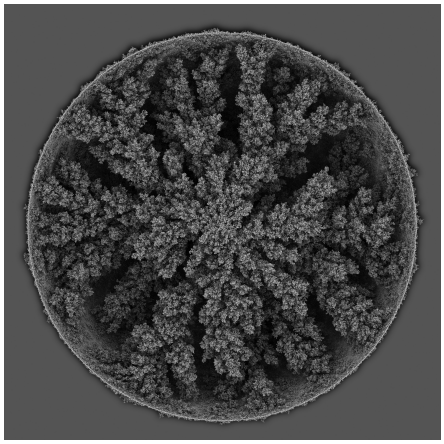
About the Cover

Aggregation 22



This month's cover is from the collection of images `http://www.bridgesmathart.org/art-exhibits/bridges06/lomas.html` by Andy Lomas, part of the "Bridges London 2006" conference covered by Mike Field elsewhere in this issue. Andy studied mathematics as an undergraduate at Trinity College Cambridge, but is currently head of computer graphics at the English company Framestore CFC, Europe's largest digital effects and animation studio. This company produced, among other things, the title sequence for *Casino Royale*.

Andy tells us, "Mathematics and visual imagery have played an important role throughout my life. From an early age I have also had deep interests in photography and filmmaking. Digital art, computer graphics, and animation have provided a very natural and fulfilling way of bringing these two paths together. Examples where I have used mathematics in my professional work include fluid effects for the 'pool of tears' sequence in a TV series *Alice in Wonderland* and an illumination model for rain that allowed us to emulate the effects of rain being illuminated from different angles, to integrate with live action in *The Matrix: Revolutions*."

As to how the image was constructed, he wrote:

> The structures in the *Aggregation* series are produced by variations on Diffusion Limited Aggregation (DLA), a stochastic model for fractal growth originally proposed by T. L. Witten and L. M. Sander (*Physical Review Letters* **47**).
>
> DLA starts with a seed particle, then deposits new particles onto the structure by creating new 'walker' particles and allowing them to move randomly by Brownian motion until they reach the aggregated cluster where they are deposited. Iterating this process over many particles, extremely complex fractal structures called 'Brownian Trees' are formed. Computer implementations of DLA commonly restrict the particles to a lattice grid, but my implementation is lattice-free and calculates the intersections of the walker particles with the clustered form analytically. I have used a piece-wise linear approximation to Brownian motion.
>
> One thing that I find particularly intriguing about *Aggregation 22* is that there appear to be distinctly different structures in the form: an interior shape and an outer shell…although there is no point in the simulation where the processes were altered to produce these two structures.
>
> The simulation stage to create the structure of *Aggregation 22* took 182 hours on a 3.2 GHz Pentium 4 processor. Rendering the image at a resolution of 8,192 by 8,192 pixels took 28 hours on the same machine.

Andy's home page is at `www.andylomas.com`.

—Bill Casselman, Graphics Editor
(`notices-covers@ams.org`)