EXPLORING CHEMICAL KINETICS FOR FLUID ANIMATION

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With the increased sophistication and use of heated gas, fire, and explosion simulations in computer graphics applications, there is a corresponding impetus to improve the visual realism in the rendering of such simulated phenomena. Although chemically reactive fluids may be used effectively to increase the reality of visual effects, little work has been done with the general modeling of chemical reactions in computer animation. In this work, we attempt to extend an established, physically based fluid simulation technique to handle reactive gaseous fluids. The proposed technique exploits the theory of chemical kinetics to account for a variety of chemical reactions that are frequently found in everyday life. In extending the existing fluid simulation method, we introduce a new set of physically motivated control parameters that allow an animator to control intuitively the behavior of reactive fluids. In visualizing the resulting fluids, an appropriate incorporation of their incandescent properties into the rendering significantly enhances the realism of visual effects. For this, we effectively synthesize the light emission phenomena of hot gaseous fluids by extending the photon mapping global illumination method. In particular, we add two new photon maps to capture the thermal radiation effects. First, we define an *emission* photon map to store the photons emitted within hot gaseous fluids. Second, we utilize an additional *flash* photon map, which is very effective in creating a flash-like effect in explosions, visually capturing shock waves. Our current technique, while based on the theory of blackbody radiation, is parameterized to enable an animator to generate a wide range of visual effects with fairly intuitive user control. We demonstrate the effectiveness of our new simulation/rendering technique and user-controlled generation of visual effects with several example pictures and animation.