Particle Systems
粒子系统

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PB10000603

Particle systems—a technique for modeling a class of fuzzy objects (SIGGRAPH 1983)

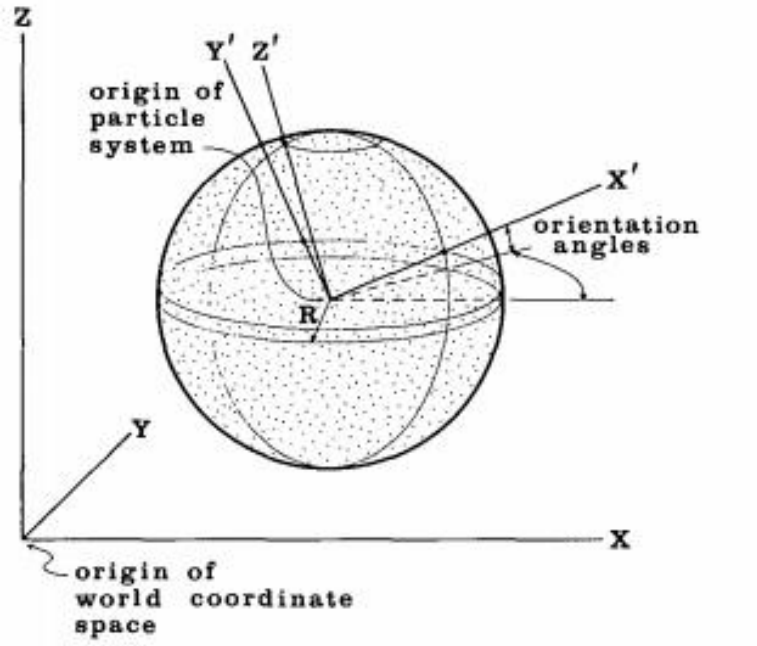


Fig. 1. Typical particle system with spherical generation shape.

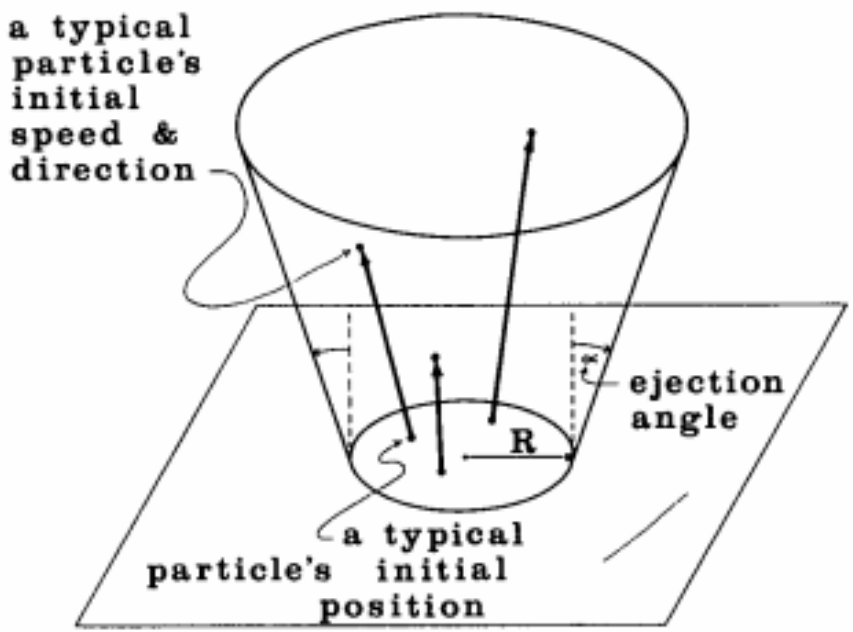


Fig. 3. Form of an explosion-like particle system.

粒子的参数

- 初始位置
- 初始速度的大小和方向
- 初始大小
- 初始颜色
- 初始透明度
- 形状
- 生存期

粒子的产生

- 如何决定产生新粒子的速度？
- 第一种方法：使新粒子产生速度有一定随机性
- Nparts = MeanParts + Rand() * VarParts
- 第二种方法：考虑到屏幕大小的影响
- Nparts = (MeanParts + Rand() * VarParts) * ScreenArea

April 1983

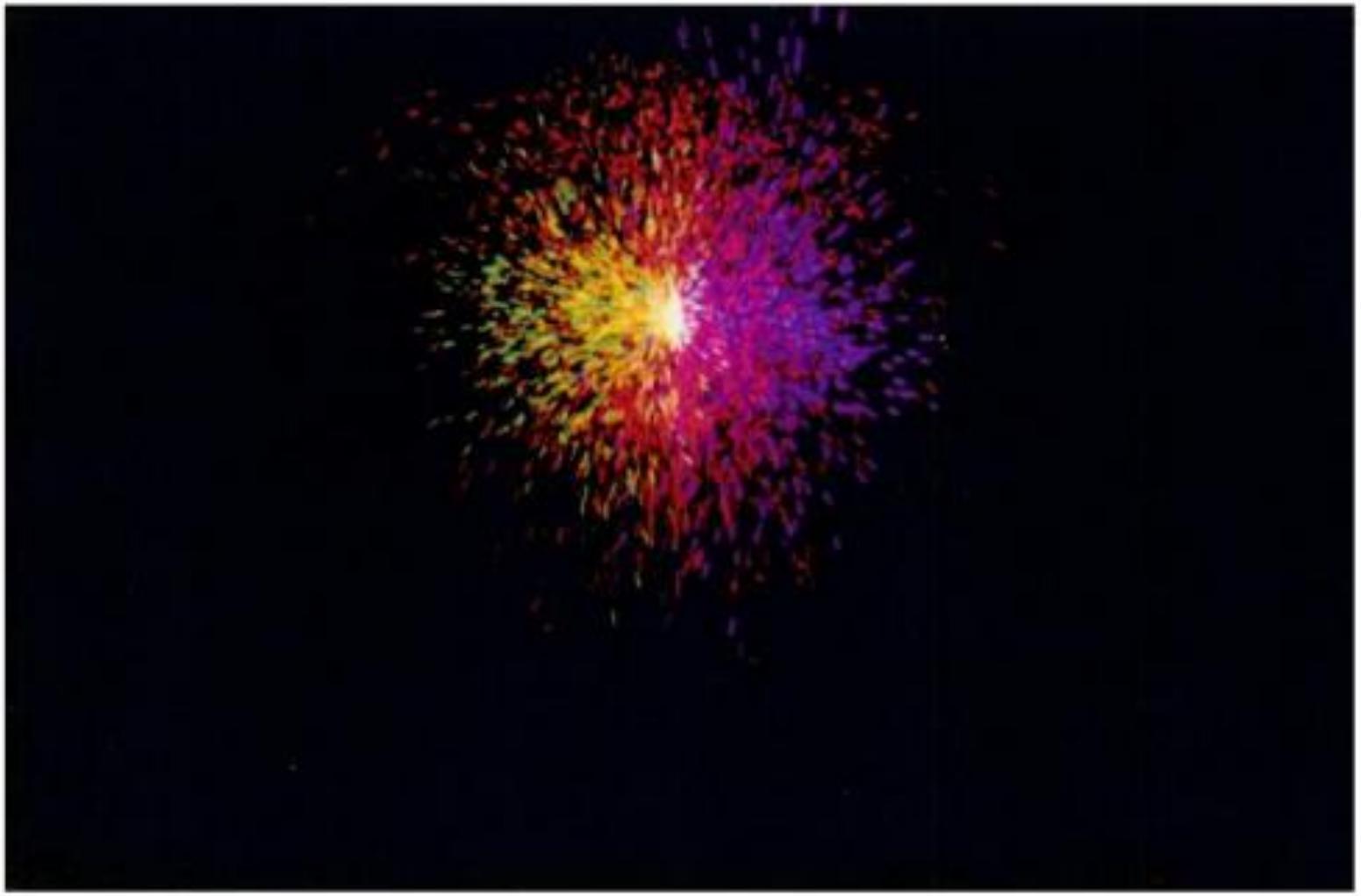
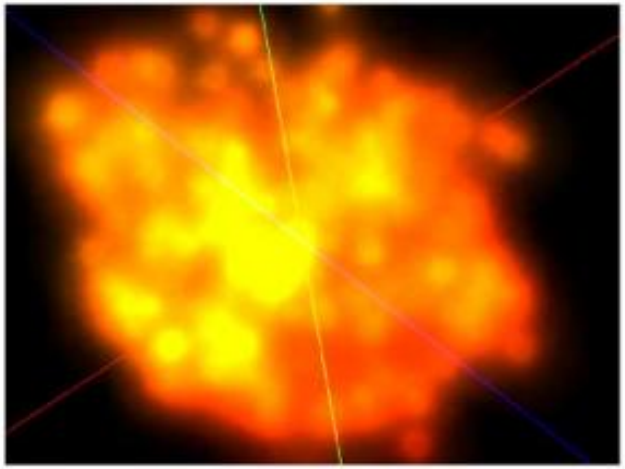
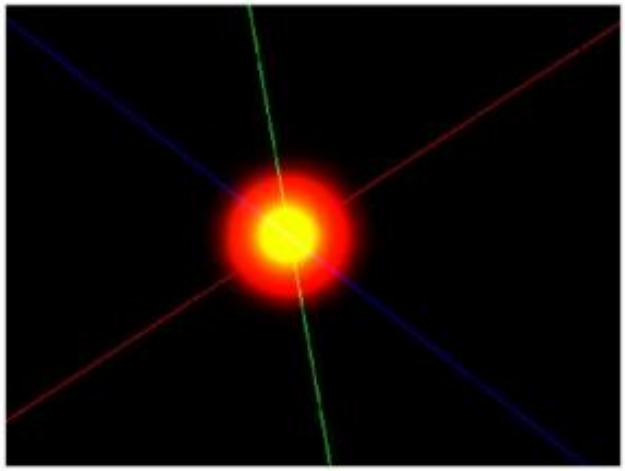


Fig. 11. Multicolored fireworks.

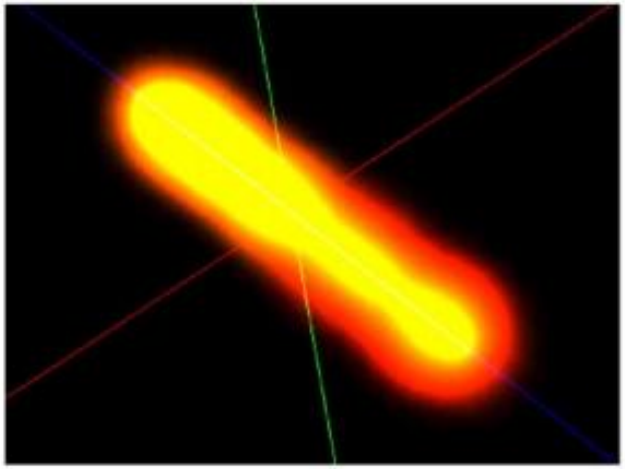
粒子形状

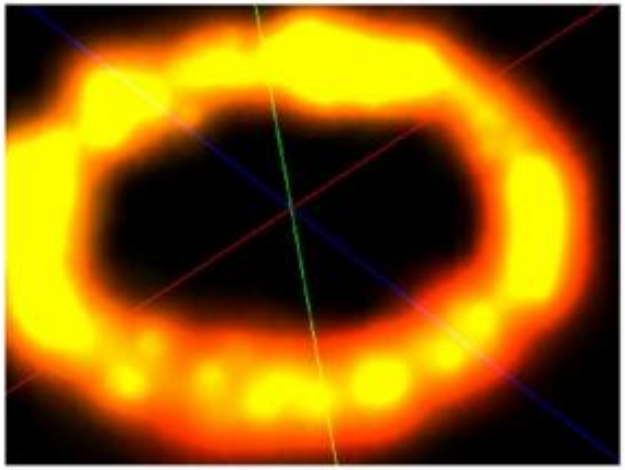


(4a)



(4b)

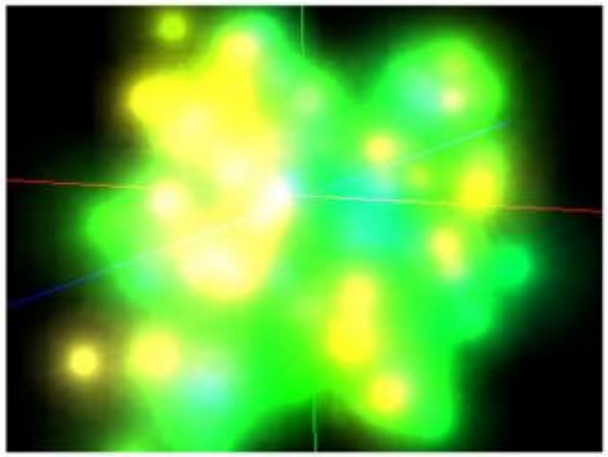




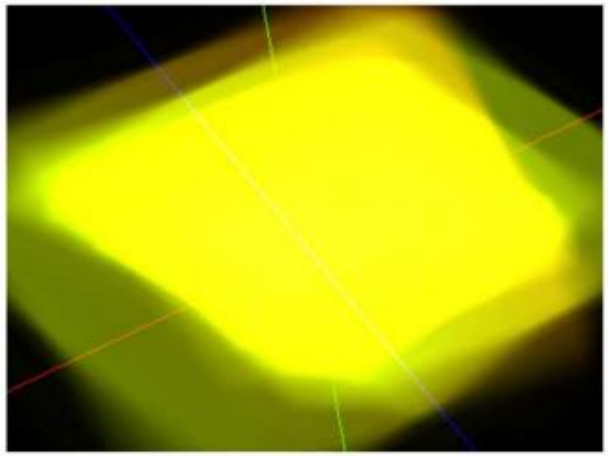
粒子形状

- Spherical generation produces area effects such as smoke and explosions.
- Point generation facilitates effects that are attached to specific points on objects, such as vehicle thrust and muzzle flash.
- Line generation commonly produces effects attached to characters or melee weapons, such as glowing swords.
- Circular generation enables effects that surround objects, such as energy fields

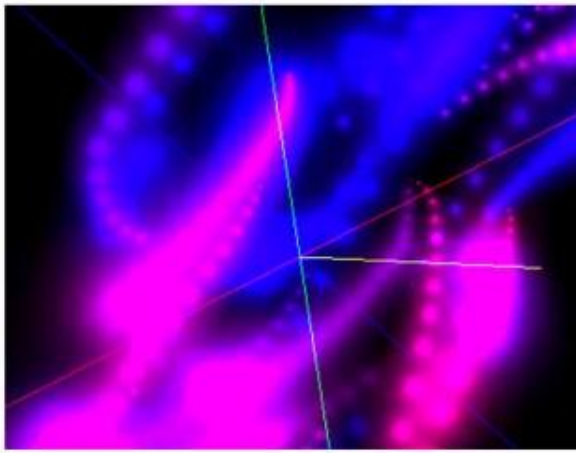
粒子系统分类

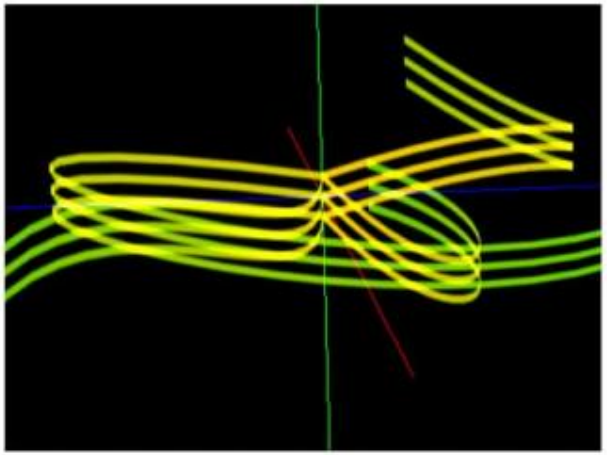


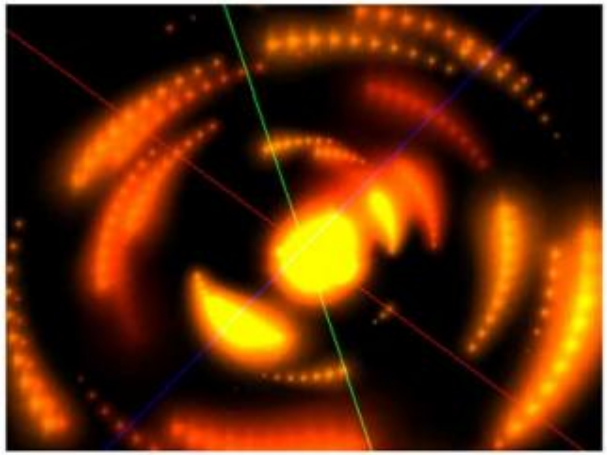
(5a)



(5b)



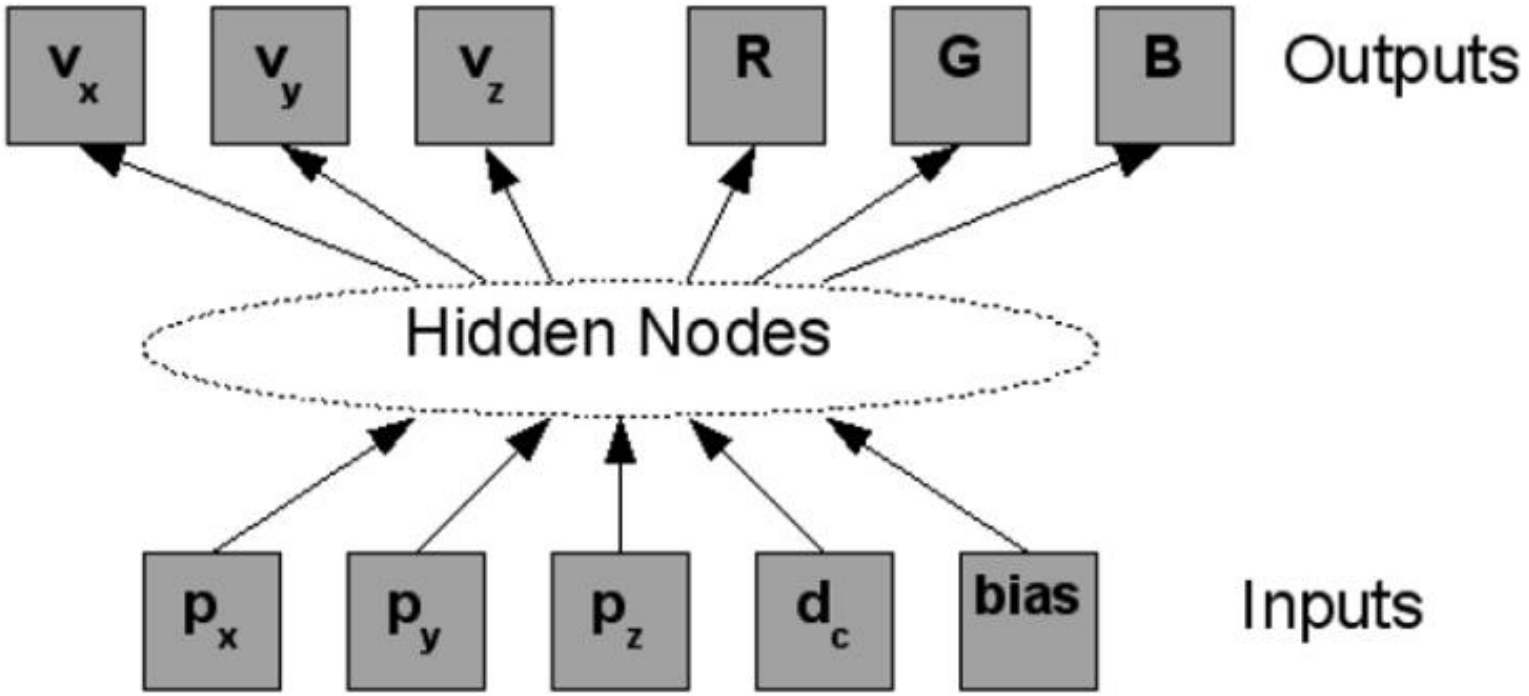




粒子系统分类

- The generic particle system models effects such as fire, smoke, and explosions.
- The plane system warps and stretches individual particles for flashes, lens flares, and other effects.
- The beam system simulates beam, laser, or electricity effects.
- The rotator system models effects based on orbital rotation common in explosions, energy, and magic.
- The trail system is similar to the generic system; however, each particle drops a trail of smaller particles.

人工神经网络

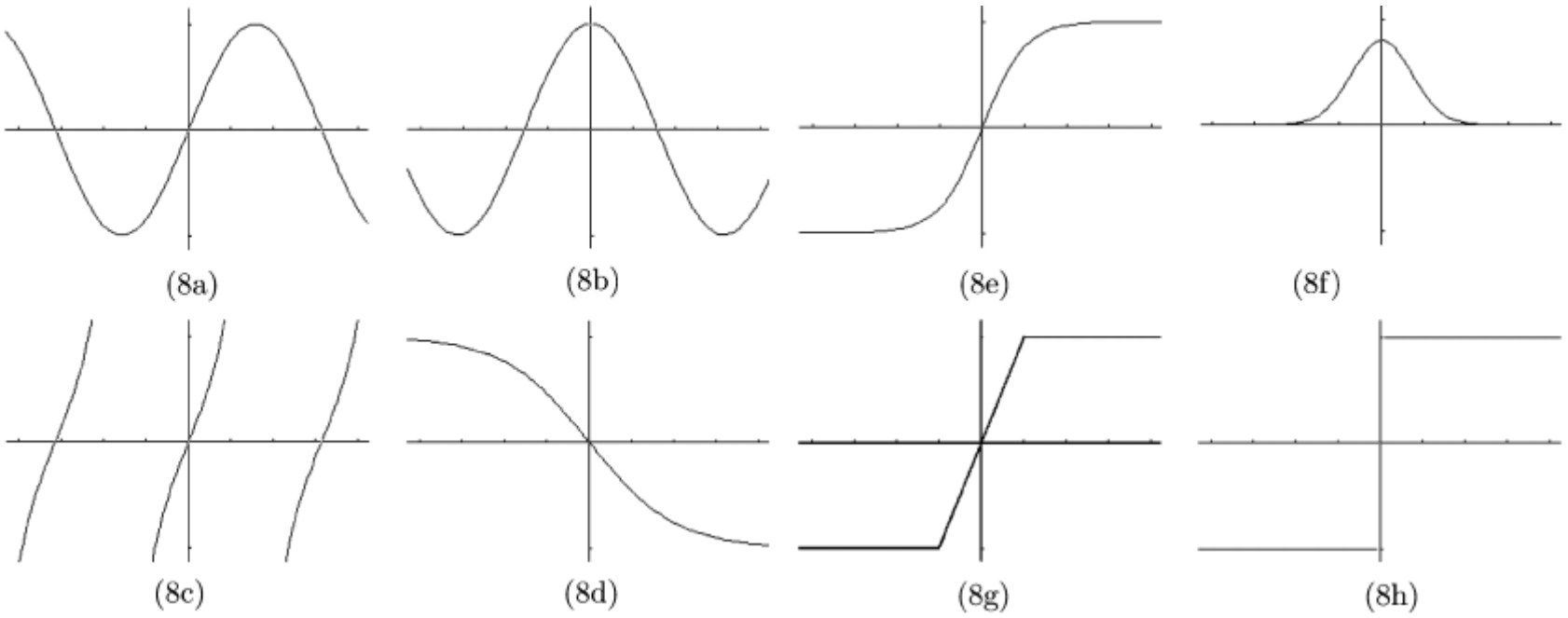


几种粒子系统的控制参数

- Generic:
  input: current position (x,y,z), distance from center (d_c)
  output: velocity (x,y,z), color (R,G,B)
- Plane system:
  input: position of each corner (x,z), distance from center (d_c)
- Beam system:
  input: position of each Bezier control point (x,y,z), distance from center (d_c)
- Rotator system:
  output: rotation around x,y,z axis, color (R,G,B)
- Trail system: 定期让部分粒子静止下来并逐渐消失

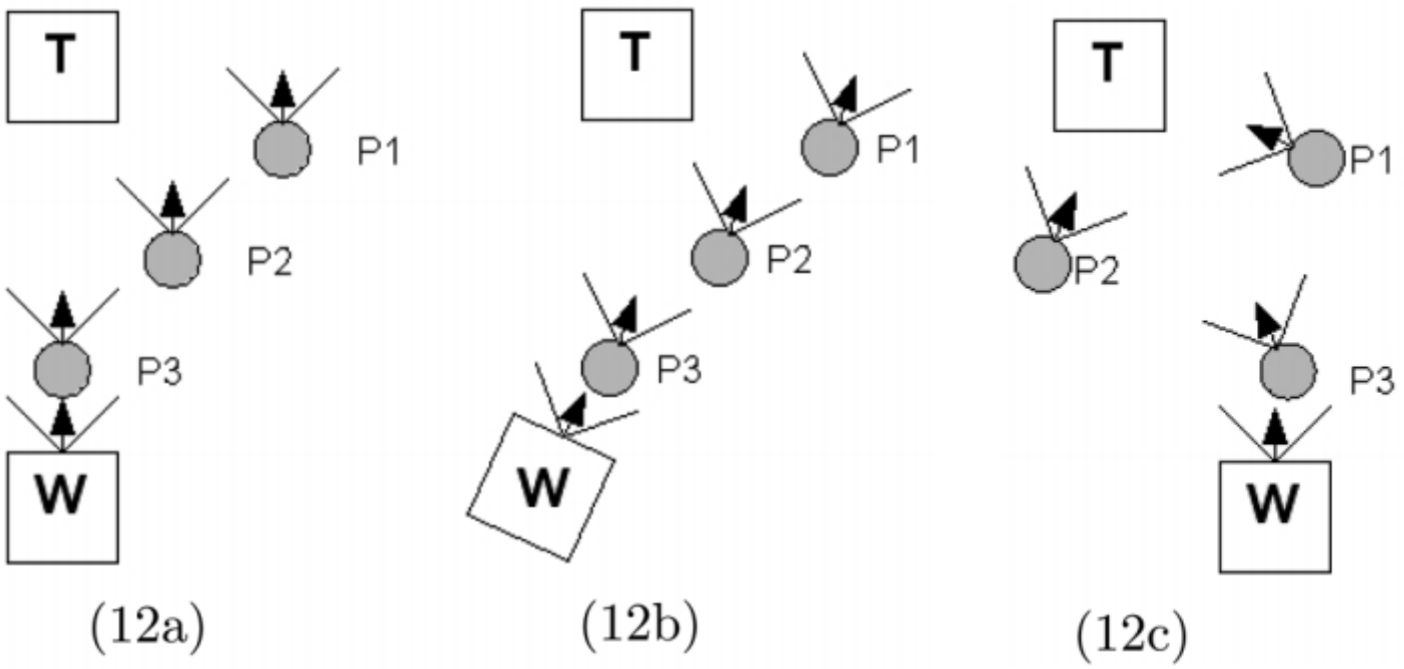
人工神经网络中的节点

- 从下面的8种函数中随机选择一个

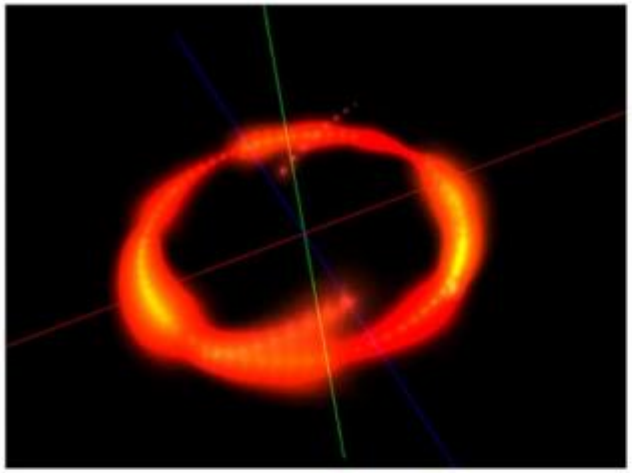


随机中的限制

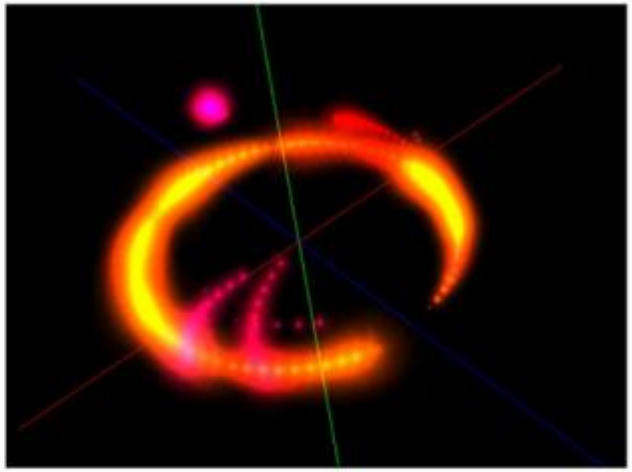
- 以武器为例，随机运动的粒子（子弹）不能返回来打到自己



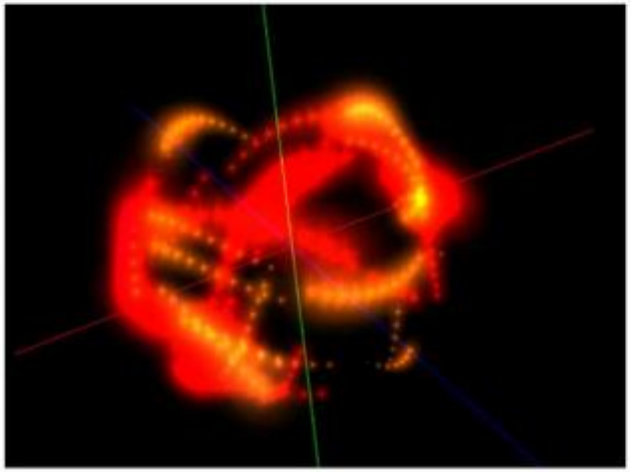
粒子系统进化的魅力

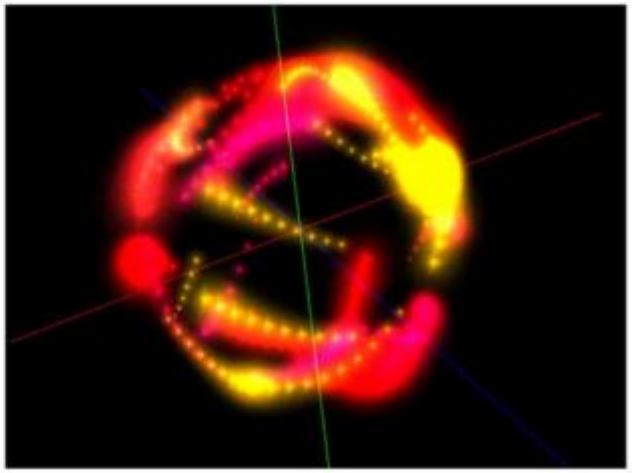


(13a)



(13b)





参考文献

- William T. Reeves. 1983. Particle systems—a technique for modeling a class of fuzzy objects. *SIGGRAPH Comput. Graph.* 17, 3 (July 1983), 359-375. DOI=10.1145/964967.801167
- Hastings, E.J.; Guha, R.K.; Stanley, K.O., "Interactive Evolution of Particle Systems for Computer Graphics and Animation," *Evolutionary Computation, IEEE Transactions on* , vol.13, no.2, pp.418,432, April 2009
- 查到的其他文献大多是引用这两篇的，这两篇是思想的集大成之作，因此没有列出其他文献。

谢谢！