Fire Smoke Simulator

This page introduces the Fire Smoke Simulator object (PhoenixFDSimulator) and its rollouts.

Overview

The Fire/Smoke simulator is intended to produce gaseous effects like fire, smoke and explosions, as well as sparks or embers.

You can think of a Phoenix Simulator as a 3D box, inside which simulations of fluids and Rigid Body Dynamics are performed. The box is divided into small cells, called voxels, which is why the box is referred to as a Simulation Grid. The voxels inside the grid can be filled with just about any type of gas or liquid, and contain the fluid's properties at a position and given time.

These fluid properties are written inside what are called Grid Channels. Each channel stores a type of value, such as Temperature or Velocity, with its own Grid Channel Range, which is the range of possible values that is most efficient for that specific channel type. Phoenix determines the fluid's behavior at a given time, based on the content of these Grid Channels.

When running a simulation, the Fire/Smoke sim will typically output an entire animation sequence. That sequence is saved as individual files, called caches, which contain raw simulation data for each timeline frame. In essence, the cache data contains grids and particles, which describe the fluid's behavior.

Fire/Smoke sim cache files can then be previewed in the viewport, as well as rendered, in order to create captivating and realistic images. The simulator offers multiple render modes, where the volumetric render modes are typically used for rendering Fire/Smoke sims, and the mesh render mode is typically used for Liquid sims. Phoenix offers a lot of flexibility though, so there is the option to render Fire/Smoke sims as meshes and Liquids as volumes, in order to achieve even more diverse effects.


Note that the simulator is represented as a single object for convenience. Internally, it contains two completely separate parts: a simulator component and a rendering component. Parameters that control the simulation are separated from those associated with the shading and rendering processes. As a result, no roll-out will contain mixed parameters, and no parameter will affect both the simulation and rendering.

UI Paths

UI Paths: ||Phoenix FD menu|| > **Create** > **Fire/Smoke Simulator**

||Phoenix FD Shelf|| > **Create Phoenix Fire/Smoke Simulator button**
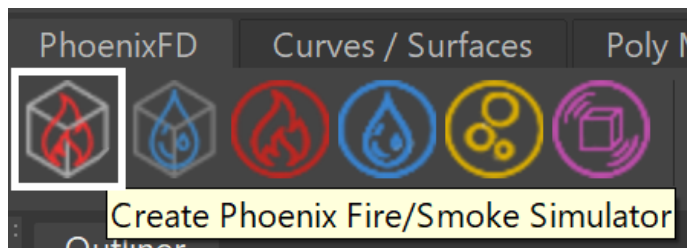
Rollouts

After creating a Phoenix Simulator object, the following rollouts can be accessed in the Attribute Editor:

- Simulation - Controls the simulation and displays statistics such as simulation times, as well as information about the data contained in the sim for the current frame.
- Simulation Speed - Helps identifying the heaviest computation phases of the simulation and provides tips on how to get results faster and more efficiently.
- Resimulation - Uses a base simulated cache sequence with exported velocity to drive a new simulation, in order to enhance details, increase its resolution, or slow down or speed up the simulation. For liquid simulations, it modifies an existing cache sequence to improve features or change specified particle systems.
- Grid - Controls the boundaries, size and resolution of the simulation grid.
- Dynamics - Offers parameters to affect fire/smoke dynamics when simulating, such as cooling, smoke dissipation, vorticity, advection, etc.
- Fuel - Controls the simulation of burning when Fuel is present in the simulation, which is useful for creating gasoline explosions or propagating fire effects.
- Scene Interaction - Specifies how the simulator interacts with other objects in the scene.
- Output - Specifies how and where the simulation cache files are saved.
- Input - Determines the path of the input files for rendering and previewing, and offers settings and controls for playback.
- Preview - Controls how the simulation is displayed in the viewport.
- Rendering - Controls how the simulation is rendered, and includes additional volumetric options for shading Fire/Smoke simulations.
- Presets – Allows the parameters of the simulator to be saved to your storage, and then loaded back as a preset.

Upgrading from Previous Versions of Phoenix

Due to many improvements to the Phoenix solver, recreating simulations the same way you did in older versions of Phoenix may not be possible because of changes to the solvers and the UI. Here are some things to be aware of when upgrading from older versions of Phoenix.

- If you have a scene created with Phoenix version 3 and you open it with version 4, it will keep all the old settings for you, including some which are not visible to newer versions, in order for the results to be roughly the same.
- If you try to manually replicate an older simulation setup with a new Phoenix simulator using Phoenix version 4, and set all the parameters with the same values as the older version, you may not obtain the same result as in Phoenix version 3 or older.
- Since the release of Phoenix version 3, Phoenix started using a new solver for liquids and fire/smoke simulations, so simulation results will be different between Phoenix version 3 and version 2.