diagonal stretch matrix is a diagonal stretch matrix of neighboring particles for at least some particles of the plurality of particles; and computing a new shape or position of the first implies surface of the first object based on the set of deformed particles. Identifying the subset of the plurality of particles whose positions are proximate to the first implied surface of the first object involves computing a weighted mean and the covariance matrix of each particle of the plurality of particles based on a mask, the mask including particles of the plurality of particles having a user-defined attribute. Other embodiments of this aspect include corresponding computer systems, apparatus, and computer programs recorded on one or more computer storage devices, each configured to perform the actions of the methods.

[0010] Implementations may include one or more of the following features. In some embodiments, the non-linear function includes a square root. In some embodiments, at least some of the particles of the plurality of particles are spherical. In some embodiments, at least some of the deformed particles are ellipsoidal. In some embodiments, deforming the particles of the subset of the plurality of particles involves elongating axes of the particles of the subset that are parallel to the first implied surface of the first object. In some embodiments, the first object is solid. In some embodiments, the first object is semi-solid or fluid. In some embodiments, a shape or position of the first implied surface of the first object changes based on an interaction of the first object with a second surface of a second object. In some embodiments, the computer-implemented method further includes generating a visual representation of the second surface of the second object. In some embodiments, the computer-implemented method further includes receiving masses for each particle of the plurality of particles including the first object. In some embodiments, the computer-implemented method further includes computing a computed pressure, density, or force acting on at least one particle of the plurality of particles including the first object. In some embodiments, the computer-implemented method further including changing the positions of the at least one particle based on the computed pressure, density, or force. In some embodiments, the positions and sizes of the particles including the first object are received from a simulation. In some embodiments, the positions and sizes of the particles including the first object are received from a scanning device.

[0011] One general aspect includes a computer system for modeling surfaces of simulated objects, the system including: at least one processor; and a computer-readable medium storing instructions, which when executed by the at least one processor, causes the system to carry out the method. Some embodiments include a non-transitory computer-readable storage medium storing instructions, which when executed by at least one processor of a computer

CLAIMS

1. A computer-implemented method for modeling surfaces of simulated objects, the computer-implemented method comprising:

under the control of one or more computer systems configured with executable instructions:

receiving positions and sizes for each particle of a plurality of particles comprising a first object;

identifying a subset of the plurality of particles whose positions are proximate to a first implied surface of the first object;

deforming particles of the subset of the plurality of particles to form a set of deformed particles by generating a covariance matrix for each particle of at least some particles of the plurality of particles, wherein the covariance matrix corresponds to a diagonal stretch matrix operated on by a non-linear function and wherein the diagonal stretch matrix is a diagonal stretch matrix of neighboring particles for at least some particles of the plurality of particles; and

computing a new shape or position of the first implied surface of the first object based on the set of deformed particles;

wherein identifying the subset of the plurality of particles whose positions are proximate to the first implied surface of the first object involves computing a weighted mean and the covariance matrix of each particle of the plurality of particles based on a mask, the mask including particles of the plurality of particles having a user-defined attribute.

2. The computer-implemented method of claim 1, wherein the non-linear function comprises a square root.

3. The computer-implemented method of claim 1, wherein at least some of the particles of the plurality of particles are spherical.

4. The computer-implemented method of claim 1, wherein at least some of the deformed particles are ellipsoidal.

5. The computer-implemented method of claim 1, wherein deforming the particles of the subset of the plurality of particles involves elongating axes of the particles of the subset that are parallel to the first implied surface of the first object.

6. The computer-implemented method of claim 1, wherein the first object is solid.

7. The computer-implemented method of claim 1, wherein the first object is semi-solid or fluid.

8. The computer-implemented method of claim 1, wherein a shape or position of the first implied surface of the first object changes based on an interaction of the first object with a second surface of a second object.

9. The computer-implemented method of claim 1, further comprising:

receiving masses for each particle of the plurality of particles comprising the first object;

computing a computed pressure, density, or force acting on at least one particle of the plurality of particles comprising the first object; and

changing the positions of the at least one particle based on the computed pressure, density, or force.

10. The computer-implemented method of claim 1, wherein the positions and sizes of the particles comprising the first object are received from a simulation.

11. The computer-implemented method of claim 1, wherein the positions and sizes of the particles comprising the first object are received from a scanning device.

12. The computer-implemented method of claim 1, wherein the covariance matrix corresponds to the diagonal stretch matrix raised to a power of -1/2.

13. The computer-implemented method of claim 1, wherein computing the new shape or position of the first implied surface of the first object based on the deformed particles involves computing an isosurface of a scalar field.

14. The computer-implemented method of claim 1, further comprising generating a visual representation of the first implied surface of the first object.

15. The computer-implemented method of claim 8, further comprising generating a visual representation of the second surface of the second object.

16. A computer system for modeling surfaces of simulated objects, the system comprising:

at least one processor; and

a computer-readable medium storing instructions, which when executed by the at least one processor, causes the system to carry out the method of claim 1.

17. A non-transitory computer-readable storage medium storing instructions, which when executed by at least one processor of a computer system, causes the computer system to carry out the method of claim 1.