Collision Detection

Collision probability matrix:

$$\begin{bmatrix} 0 & p_{12} & p_{13} & p_{14} & \dots & p_{1n} \\ p_{21} & 0 & p_{23} & p_{24} & \dots & p_{2n} \\ p_{31} & p_{32} & 0 & p_{34} & \dots & p_{3n} \\ p_{41} & p_{42} & p_{43} & 0 & \dots & p_{4n} \\ \dots & \dots & \dots & \dots & \dots & \dots \\ p_{n1} & p_{n2} & p_{n3} & p_{n4} & \dots & 0 \end{bmatrix}$$

Collision probability matrix:

$$\begin{bmatrix} x_i(t) \\ y_i(t) \\ z_i(t) \end{bmatrix} = \begin{bmatrix} x_i(0) \\ y_i(0) \\ z_i(0) \end{bmatrix} + t * \begin{bmatrix} v_{i,x}(0) \\ v_{i.y}(0) \\ v_{i,z}(0) \end{bmatrix}$$

$$d_{ij}(t) = \sqrt{(x(t)_i - x(t)_j)^2 + (y(t)_i - y(t)_j)^2 + (z(t)_i - z(t)_j)^2}$$

$$r = \begin{bmatrix} x_1(0) \\ y_1(0) \\ z_1(0) \\ v_{1,x}(0) \\ v_{1,y}(0) \\ v_{1,z}(0) \\ r_1 \\ \dots \\ x_n(0) \\ y_n(0) \\ z_n(0) \\ v_{n,x}(0) \\ v_{n,y}(0) \\ v_{n,z}(0) \\ r_n \\ t \end{bmatrix}$$

$$p_{ij} = E\{C_{ij}\} = \sum_{k=1}^{m} \frac{\delta(C_{i,j})}{m}$$