Errata for Third Edition of *Essential Mathematics for Games and Interactive Applications*

December 18, 2016

Page 5, middle should read "[...] and that the mantissa be "normalized" (i.e. have magnitude in the range $[1.0, 10.0)$)."

Page 49, Figure 2.12, the bottom element is the length of the projection. If we rearrange the projection formula, you end up with the length $(\mathbf{v} \bullet \mathbf{w})/\|\mathbf{w}\|$ multiplied by the unit vector $\mathbf{w}/\|\mathbf{w}\|$. Hence the label should read $(\mathbf{v} \bullet \mathbf{w})/\|\mathbf{w}\|$ or alternatively $\|\mathbf{v}\| \cos(\theta)$.

Page 103, second paragraph, last sentence should read "There is a single solution only if the rank of $\mathbf{A}$ and $\mathbf{A}|\mathbf{b}$ are equal to the the number of unknowns n."

Page 110, last paragraph, second sentence should read "The first part of the determinant sum is $u_{0,0} \det(\tilde{\mathbf{U}}_{0,0})$". Similiarly the second to last equation should read:

$$\det(\mathbf{U}) = u_{0,0} \det(\tilde{\mathbf{U}}_{0,0})$$

Page 113, second to last sentence should read "[...] and the diagonal elements of $\mathbf{D}$ are the corresponding eigenvalues."

Page 121, Figure 4.1. The labels x and y should be swapped. The coordinate system shown is left-handed, and is intended to be right-handed.

Page 124, Figure 4.5. The labels x and y should be swapped. Correspondingly, Figure 4.5 (a) now represents y-axis rotation, and Figure 4.5 (b) represents x-axis rotation.

Page 131, Figure 4.8. The labels x and y should be swapped.

Page 132, Figure 4.9. The labels x and y should be swapped. Correspondingly, Figure 4.9 (a) now represents xz reflection, and Figure 4.9 (b) represents yz reflection.

Page 134, Figure 4.11. The labels x and y should be swapped.

Page 135, Figure 4.12. The labels x and y should be swapped.

Page 158, last paragraph of Section 5.4.1, second sentence should read "Near-parallel vectors may cause us some problems because either the floating point calculation of the dot product could give a value exceeding 1, which is invalid input to arccos, or [...]"

Page 166, Equation 5.7 should read

$$\mathbf{q} = (2\cos\theta + 2, 2\sin\theta\hat{\mathbf{r}})$$

The end of the second sentence in the remainder of that paragraph should read "[...] we just need to compute $(\mathbf{w}_0 + \mathbf{w}_1)/2$."

Page 169, top equation should read

$$\boldsymbol{i}^2 = \boldsymbol{j}^2 = \boldsymbol{k}^2 = \boldsymbol{ijk} = -1$$

Page 172, the equation after Equation 5.13 should read

$$\begin{aligned} R_{\mathbf{q}}(\mathbf{p}) = {} & \left(2\cos^2\left(\frac{\theta}{2}\right) - 1\right)\mathbf{p} \, + \, 2\left(\hat{\mathbf{r}}\sin\left(\frac{\theta}{2}\right) \bullet \mathbf{p}\right)\hat{\mathbf{r}}\sin\left(\frac{\theta}{2}\right) \\ & + 2\cos\left(\frac{\theta}{2}\right)\left(\hat{\mathbf{r}}\sin\left(\frac{\theta}{2}\right) \times \mathbf{p}\right) \end{aligned}$$

Page 208, the second set of equations should read:

$$\begin{aligned} a(t) &= \frac{\cos(t\theta) - \cos((1-t)\theta)\cos\theta}{(1-\cos^2\theta)} \\ b(t) &= \frac{\cos((1-t)\theta) - \cos(t\theta)\cos\theta}{(1-\cos^2\theta)} \end{aligned}$$

Page 272, the third equation should read:

$$x_v = \frac{2a}{w_s}(x_s - s_x) - a$$

and the corresponding matrix equation below it should be

$$\begin{bmatrix} x_v \\ y_v \\ z_v \end{bmatrix} = \begin{bmatrix} \frac{2a}{w_s} & 0 & -\frac{2a}{w_s}s_x - a \\ 0 & -\frac{2}{h_s} & \frac{2}{h_s}s_y + 1 \\ 0 & 0 & -d \end{bmatrix} \begin{bmatrix} x_s \\ y_s \\ 1 \end{bmatrix}$$

Page 539, Equation 13.8 should read

$$\mathbf{L} = \mathbf{I}\,\omega$$

Page 547. The discussion of the coefficient of restitution here is not entirely correct. There is a single coefficient of restitution for a given pair of objects, not an individual coefficient per object. This value depends on the physical properties of both objects. One possible approximation is to set an "elasticity" value per object which represents the coefficient of restitution when that object strikes another perfectly elastic object, and for a given collision multiply the two elasticities together to get ϵ. However, this is unlikely to be physically correct, and it would be more accurate to store a table of values, one per pair of materials, determined through experimentation.