ERRATA

A SURVEY OF CLASSICAL AND MODERN GEOMETRIES

The following is a list of known errors in the *third and fourth printing* of the book *A Survey of Classical and Modern Geometries: with computer activities*. These will be corrected in the fifth printing. I have placed asterisks next to some corrections. No asterisk – a typo with an obvious correction. One asterisk (*) – a typo with a less obvious correction. Two asterisks (**) – a mistake that, when caught, the readers might question whether I made the mistake or they did. Three asterisks (***) – a subtle error.

The errors have been ordered by page number. The number after the page number is the line where the error is. A negative number means the line is counted from the bottom. Two or more numbers mean there are corrections on several lines.

I would like to thank Michael Woltermann, Robin Hartshorne, James Katseane, and Victoria Sapko for pointing out some of these errors.

*****p 254, 8, -10:** The way this section reads, it implies that one can define the angle between any two lines, whether they intersect or not. This is not true. One can do it only for intersecting lines, so in these two lines of text, where it reads "the angle between two lines," we insert the word "intersecting," so it reads "the angle between two intersecting lines." The section relies on Exercise 12.19, which asks the reader to prove a false result. We fix this below.

p 255, 4: The definition should be $\vec{\mathrm{P}} \otimes \vec{\mathrm{Q}} = J^{-1}P \times Q$. Of course, for our J, we have $J^{-1} = J$, so in some sense, no correction is required. However, more generally, any symmetric J with two positive eigenvalues and one negative eigenvalue defines a Lorentz product. For such a Lorentz product, the definition of the Lorentz cross product must be changed as noted.

*****p 255, Exercise 12.19:** This exercise should read as follows: "Suppose $||\vec{\mathrm{a}}|| = ||\vec{\mathrm{b}}|| = 1$ and the lines on $\mathcal{V}^+$ described by $\vec{\mathrm{a}} \circ \vec{\mathrm{x}} = 0$ and $\vec{\mathrm{b}} \circ \vec{\mathrm{x}} = 0$ intersect in $\mathcal{V}^+$. Prove that there exists $T \in \mathrm{O}_J^+$ such that $T\vec{\mathrm{a}} = (1, 0, 0)$ and $T\vec{\mathrm{b}} = \vec{\mathrm{b}}' = (b_1', b_2', 0)$." The original exercise could not possibly be true, since it would imply that all lines on $\mathcal{V}^+$ intersect. The error in the solution manual is the statement that $\tanh x$ is invertible on $\mathbb{R}$. The range of $\tanh x$ is only $(-1, 1)$.

p 255, Exercise 12.20: Following up on the remark above (for p 255, line 4), this exercise depends on our choice of J. More generally, the properties one can

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prove are

$$\vec{u} \otimes \vec{v} = \lambda J\vec{u} \times J\vec{v}$$
$$\vec{u} \otimes \vec{v} = -\vec{v} \otimes \vec{u}$$
$$\vec{u} \circ (\vec{v} \otimes \vec{w}) = \det \begin{bmatrix} u_1 & u_2 & u_3 \\ v_1 & v_2 & v_3 \\ w_1 & w_2 & w_3 \end{bmatrix}$$
$$\vec{u} \otimes (\vec{v} \otimes \vec{w}) = \lambda((\vec{u} \circ \vec{w})\vec{v} - (\vec{u} \circ \vec{v})\vec{w})$$
$$(\vec{u} \otimes \vec{v}) \circ (\vec{w} \otimes \vec{x}) = \lambda \det \begin{bmatrix} \vec{u} \circ \vec{w} & \vec{u} \circ \vec{x} \\ \vec{v} \circ \vec{w} & \vec{v} \circ \vec{x} \end{bmatrix},$$

where $\lambda = \det J^{-1}$. And in Exercise 12.21, the i is really $\sqrt{\det J^{-1}}$.

***p 261, -10:** This should read $\vec{F}' = \vec{B} + \lambda(\vec{A} - \vec{B}) = \ldots.$

****p 264, property 11 of a field:** Property 11 should read "$a \cdot (b + c) = a \cdot b + a \cdot c$ and $(a + b) \cdot c = a \cdot c + b \cdot c$." This modification is not necessary, since in property 8 we require $a \cdot b = b \cdot a$. However, I later refer to a division ring as something that satisfies all the properties of a field except property 8. This is not true, unless property 11 is modified, as above.

***p 321, 10:** The first term on the right hand side of this displayed equation should be $(\tau_3\tau_4 + \tau_2\tau_4 + \tau_2\tau_3)$.

p 321, -6: This should be substituted into Equation 15.6, not 15.7.

p 342, 15, in the answer to Ex 1.52: The length is of $|DE|$, as asked in the exercise (not $|BD|$).

***p 343, -6 and -4:** The terms 'reflexive' and 'symmetric' are switched. Also, to conclude symmetry from reflexivity and transitivity, we need to know that an object is similar to some other object. This is guaranteed by property 1.

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