ODE vol. 1
Chapter 8
Corrections

Dr. L. Płociniczak, a coauthor of [1], pointed out that eq. (8.1) is incorrectly stated as

$$-T\frac{d^2h/dx^2}{\sqrt{1+(dh/dx)^2}}+kh=\frac{P}{\sqrt{1+(dh/dx)^2}} \tag{8.1a}$$

The corrected equation is

$$-T\frac{d^2h/dx^2}{\left(\sqrt{1+(dh/dx)^2}\right)^3}+kh=\frac{P}{\sqrt{1+(dh/dx)^2}} \tag{8.1b}$$

or

$$-T\frac{d^2h/dx^2}{(1+(dh/dx)^2)^{3/2}}+kh=\frac{P}{\sqrt{1+(dh/dx)^2}} \tag{8.1c}$$

or

$$\frac{d^2h/dx^2}{(1+(dh/dx)^2)^{3/2}}-ah+\frac{b}{\sqrt{1+(dh/dx)^2}}=0 \tag{8.1d}$$

with $a=k/T, b=P/T$.

The coding in `corneal_1.R, corneal_2.R` has been changed from

```
sr[i]=sqrt(1+ux[i]^2);
if(ncase==1){ut[i]=uxx[i]/sr[i]-a*u[i]+b/sr[i];}
```

to

```
sr[i]=sqrt(1+ux[i]^2);sr3=sr[i]^3;
if(ncase==1){ut[i]=uxx[i]/sr3-a*u[i]+b/sr[i];}
```

With this correction, the numerical output changes from `u(x=0.75xl,t=1)=0.15864` (original) to `u(x=0.75xl,t=1)=0.17698` (corrected) or a (maximum relative) change of

`(0.17698-0.15864)/0.17698*100=10.36%`

Similarly, a comparison of the `ncase=1` output (corrected), `u(x=0.75xl,t=1)=0.17698`, and the `ncase=2` output, `u(x=0.75xl,t=1)=0.15167`, gives

`(0.17698-0.15167)/0.17698*100=14.30%`

These changes are small on an absolute basis so that the associated plots of the solution appear to change very little.

References

[1] Okrasiński, W., and L. Płociniczak (2012), A nonlinear mathematical model of the corneal shape, *Nonlinear Analysis: Real World Applications*, **13** 1498-1505