

Page 24, Software update, gdapy01_07, dot product

I am rather aghast that the new versions of numpy, scipy and matplotlib have depreciated some common coding “phrases”. The one relevant here is that a 1×1 array no longer count as a scalar. This breaks a lot of the code. So I am now (May 24, 2024) coding the dot product $s = \mathbf{a} \cdot \mathbf{b}$ as

```
s=np.matmul(a.T,b); s=s[0,0];
```

and not as

```
s=np.matmul(a.T,b);
```

That is, s is overwritten by its first element. In cases where the dot product appears in an expression, I have broken it out into several lines. E.g. what was

```
t=a/sqrt(np.matmul(a.T,a));
```

becomes

```
asq=np.matmul(a.T,a); asq=asq[0,0];  
t=a/sqrt(asq);
```

I have not (yet) made any effort to add to these errata specific places in the book where this kind of change has been made.

I am rather aghast that the new versions of numpy, scipy and matplotlib have depreciated some common coding methods. The one relevant here is that the `tol` keyword of `la.bicg()` has been changed to `rtol`. This breaks a lot of the code.

Thus the new command

```
q=la.bicg(LO, FTh, rtol=tol, maxiter=maxit);
```

replaces the old

```
q=la.bicg(LO, FTh, tol=tol, maxiter=maxit);
```

Also, I am now explicitly casting the result to a `float`, with the new command

```
mest=gda_cvec(q[0].astype(float));
```

which replaces

```
mest=gda_cvec(q[0]);
```

However, I'm not sure this is necessary. But it doesn't hurt.

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Page 143, Equation 7.32, correction

Delete factor of Δt as shown

$$\frac{\mathbf{m}^{(m)} - \mathbf{m}^{(m-1)}}{\Delta t} = \mathbf{Z} \mathbf{m}^{(m-1)} + \cancel{\Delta t} \mathbf{q}^{(m-1)} \quad (7.32)$$

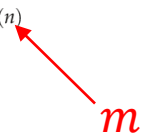
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Page 143, Equation 7.33, correction

Change of n to m as shown

$$\mathbf{m}^{(m)} = \mathbf{D}\mathbf{m}^{(m-1)} + \mathbf{s}^{(m-1)} \quad \text{or} \quad -\mathbf{D}\mathbf{m}^{(m-1)} + \mathbf{I}\mathbf{m}^{(m)} = \mathbf{s}^{(m-1)} \quad (7.33)$$

with $\mathbf{D} \equiv \Delta t \mathbf{Z} + \mathbf{I}$ and $\mathbf{s}^{(m)} \equiv \Delta t \mathbf{q}^{(n)}$



m

Page 149, Problem 7.2, clarification

Change the word “car” to “object” and insert the word “position” as indicted.

- 7.2 An object moving horizontally in the u -direction is decelerating due to a resistive force $f = -cmv$ that is proportional to its mass m , velocity v , and a constant $c = 0.01$. The ~~car~~ starts at position $u = 0$ with initial velocity $v_0 = 1$. Newton's law implies $du/dt = v$ and $dv/dt = -cv$. (A) What are the dynamical quantities \mathbf{Z} , \mathbf{q} , \mathbf{D} , \mathbf{s} in Eqs. (7.32) and (7.33)? (B) Create noise-free data by stepping Eq. (7.33) forward in time (say, with $\Delta t = 1$). (C) Create noisy data by adding Normally distributed random noise with zero mean and variance $\sigma_d^2 = (0.1)^2$ to the noise-free data. (D) Assuming that the dynamical equation (which is ultra-simplified) has variance $\sigma_s^2 = (0.01)^2$, use Kalman filtering to estimate $u(t)$. Comment upon the results.

object

position

Add the following sentence at the end of Section 11.6:

The posterior covariance of the solution can be estimated as:

$$[\text{cov } \mathbf{x}^{(n)}] \approx (\mathbf{I} - [\text{cov } \mathbf{x}] \mathbf{F}^T [\mathbf{F} [\text{cov } \mathbf{x}] \mathbf{F}^T]^{-1} \mathbf{F}) [\text{cov } \mathbf{x}]$$

where $\mathbf{F} \equiv \mathbf{F}^{(p)}$ is from the last iteration.