Chapter 4: Vector Spherical Harmonics

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July 11, 2018

1 Representation 2 of Vector Fields

The second representation of vector fields include E_{lm}, F_{lm}, and C_{lm}.

E_{lm}: vector components from the gradient of a potential field from a planet.
F_{lm}: vector components from the gradient of a potential field from outside the satellite radius (space).
C_{lm}: same as in representation 1.

We can determine the vector spherical harmonics by first setting parameters:

```
L = 2;
theta = 0:0.01:pi;
phi = 0:0.01:2*pi;
```

Now we can set values

Now let's find the vector spherical harmonics, starting with `elm`:

```
[Elm,theta,phi] = elm(L,theta,phi);
```

Similarly, we can find `flm` and `clm`:

```
[Flm,theta,phi] = flm(L,theta,phi);
[Blm,Clm,theta,phi] = blmclm([],[],theta,phi);
```

To plot the spherical harmonic coefficients, we must first convert each of the vector components into lmcosi format. To do so, we can use the following:

```
elmcosi = coef2lmcosi(Elm,1) **DID NOT WORK
flmcosi = fcoef2flmcosi(Flm,1);
[blmcosi,clmcosi] = coef2blmclm(Clm,L);
```

Now we can convert these to xyz coordinates by running:

```
[elm,elon,elat] = elm2xyz(elmcosi,1);
[flm,flon,flat] = flm2xyz(flmcosi,1);
```

The output of each of these provide fields `elm{1}` (radial component), `elm{2}` (theta or colatitudinal component), and `elm{3}` (phi or longitudinal component). This is also true for `flm{i}`. The first dimension of the field is latitude and the second is longitude.

```
[blmclm,lon,lat] = blmclm2xyz(blmcosi,clmcosi,1);
```

This will output a field with `blmclm(:,:,1)` as the phi component and `blmclm(:,:,2)` as the theta component. See the `help` functions for each of these to examine their outputs in further detail.

Finally, we can plot these:

```
plotplm(elm,elon,elat,4,1)?
```

If the vector field is represented as a linear combination of elm and flm, then we will need to evaluate elm and flm separately then sum them.

This tutorial is currently under construction. Please check back later for more by keeping your software updated.