VGFKV

This code sets up a series of unit vectors in the direction of the outgoing plane waves. It outputs these unit vectors to a file.

Why we need this

For VGFFMC We want to find the scattered field from a particle being hit by a plane wave. The code sould find $\mathbf{E}$

In the dissertation we defined

$$\mathbf{F}(\mathbf{r}) \equiv \mathbf{E}(\mathbf{r})(1 + \frac{4\pi}{3}\chi(\mathbf{r})) \quad 38$$

We want the electric field so we want

$$\mathbf{E}(\mathbf{r}) = \frac{\mathbf{F}(\mathbf{r})}{(1 + \frac{4\pi}{3}\chi(\mathbf{r}))}$$

so we ned to calculate $\mathbf{F}(\mathbf{r})$ and $\chi(\mathbf{r})$

$$\tilde{F}_{\beta j} = \sum_{N=1}^{N_k} a_{Nj}\Psi_{\beta N} \quad \#$$

The $\Psi_{\beta N}$ are a series of plane waves

$$\Psi_{\beta N} = e^{imk\hat{\mathbf{k}}_N \cdot \mathbf{r}_\beta} \quad \#$$

and the a_{Nj} is a set of coefficients. So our E field comes out as a series expansion where our explansion funcitons are $\Psi_{\beta N}$. We need the a_{Nj}

The a_{Nj} come from a matrix inversion

$$(\mathbf{a}) = (\mathbf{H})^{-1}(\mathbf{Y}) \quad \#$$

where $\mathbf{H}$ and $\mathbf{Y}$ are given by

$$H_{MlNj} = \Psi^*_{\gamma M}\left(1_{\alpha i\gamma l} - W^*_\beta G^*_{\alpha i\gamma l}\right)(1_{\alpha i\beta j} - W_\beta G_{\alpha i\beta j})\Psi_{\beta N}$$

$$Y_{Nj} = (1_{\alpha i\beta j} - W_\beta G_{\alpha i\beta j})^* E^o_{\alpha i}\Psi^*_{\beta N} \quad \#$$

or more compactlyl (and how it is done in the code)

$$T_{\alpha iNj} = \sum_\beta (1_{\alpha i\beta j} - G_{\alpha i\beta j}W_\beta)\Psi_{\beta N} \quad \#$$

Using $T_{\alpha iNj}$, H_{MlNj} and Y_{Nj} can be expressed as

$$H_{MlNj} = \sum_\alpha \sum_i T^*_{\alpha iMl}T_{\alpha iNj} \quad \#$$

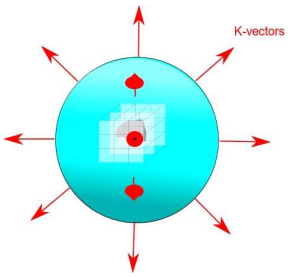
$$Y_{Nj} = \sum_\alpha \sum_i T^*_{\alpha iNj}E^o_{\alpha i}$$

The $T_{\alpha iNj}$ depend on

$$\Psi_{\beta N} = e^{imk\hat{\mathbf{k}}_N \cdot \mathbf{r}_\beta} \quad \#$$

which depend on the $\hat{\mathbf{k}}_N$

These are read in from a file. That file is created by vgfkv.f. And it looks like it makes a k_N in equally spaced increments in the θ and ϕ directions.



So we have what looks like a set of arrows in a spherical shape pointing away from the particle. Maybe we could experiment with non-uniform distributions of these?