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In[1]:= Clear["Global`*"];
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1. Readme

1. The integral kernels are focused, i.e. $\int_{z1}^{z2} \int_{\lambda1}^{\lambda2} \int_{r1}^{r2} dr' d\lambda' dz'$ should be added for the below expressions.
2. The kernels' formulas of the GC in Table 3 are represented as the following PhyVrrr, PhyVrr λ , PhyVrrz, PhyV $\lambda\lambda$ r, PhyV $\lambda\lambda\lambda$, PhyV $\lambda\lambda$ z, PhyVzzr, PhyVzz λ , and PhyVzzz.
3. (r, λ , z) and (r3, λ 3, z3) (i.e. (r', λ ', z')) are the cylindrical coordinates of the computation and integration points.

2. Test Laplace's equation for the GC in Table 3

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In[2]:= l = Sqrt[r^2 + r3^2 - 2 * r * r3 * Cos[\lambda - \lambda3] + (z - z3)^2];  
In[3]:= PhyVrrr = 3 * G * \rho * r3 * (r - r3 * Cos[\lambda - \lambda3]) * (3 * l^2 - 5 * (r - r3 * Cos[\lambda - \lambda3])^2) / l^7;  
In[4]:= PhyVrr\lambda = -3 * G * \rho * r3^2 * Sin[\lambda - \lambda3] * (4 * l^2 - 5 * (z - z3)^2 - 5 * r3^2 * (Sin[\lambda - \lambda3])^2) / l^7;  
In[5]:= PhyVrrz = 3 * G * \rho * r3 * (z - z3) * (l^2 - 5 * (r - r3 * Cos[\lambda - \lambda3])^2) / l^7;  
In[6]:= PhyV\lambda\lambda r = 3 * G * \rho * r3 * (r - r3 * Cos[\lambda - \lambda3]) * (l^2 - 5 * r3^2 * (Sin[\lambda - \lambda3])^2) / l^7;  
In[7]:= PhyV\lambda\lambda\lambda = 3 * G * \rho * r3^2 * Sin[\lambda - \lambda3] * (3 * l^2 - 5 * r3^2 * (Sin[\lambda - \lambda3])^2) / l^7;  
In[8]:= PhyV\lambda\lambda z = 3 * G * \rho * r3 * (z - z3) * (l^2 - 5 * r3^2 * (Sin[\lambda - \lambda3])^2) / l^7;  
In[9]:= PhyVzzr = 3 * G * \rho * r3 * (r - r3 * Cos[\lambda - \lambda3]) * (l^2 - 5 * (z - z3)^2) / l^7;  
In[10]:= PhyVzz\lambda = 3 * G * \rho * r3^2 * Sin[\lambda - \lambda3] * (l^2 - 5 * (z - z3)^2) / l^7;  
In[11]:= PhyVzzz = 3 * G * \rho * r3 * (z - z3) * (3 * l^2 - 5 * (z - z3)^2) / l^7;  
In[12]:= Laplace1 = FullSimplify[PhyVrrr + PhyV\lambda\lambda r + PhyVzzr]  
Out[12]= 0  
  
In[13]:= Laplace2 = FullSimplify[PhyVrr\lambda + PhyV\lambda\lambda\lambda + PhyVzz\lambda]  
Out[13]= 0  
  
In[14]:= Laplace3 = FullSimplify[PhyVrrz + PhyV\lambda\lambda z + PhyVzzz]  
Out[14]= 0  
  
In[15]:= NotebookSave[EvaluationNotebook[]];
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