(%i1) load("cliffordan")$

package name: clifford.mac
author: Dimiter Prodanov
version: v24
Recommended location: share/contrib
last update: 20 Feb 2019
warning: redefining @
package name: cliffordan.mac
author: Dimiter Prodanov
version: v18
Recommended location: share/contrib
last update: 04 Feb 2018

Euclidean 3D space

(%i2) clifford(e,3);

(%o2) $[1,1,1]$

(%i3) r:cvect([x,y,z]);

(r) $e_1\,x+e_2\,y+e_3\,z$

Green function

(%i4) G:r/sqrt(-cnorm(r))^3/(4*%pi);

(G) $$\frac{\frac{1}{4}\left(e_1\,x+e_2\,y+e_3\,z\right)}{\pi\left(x^2+y^2+z^2\right)^{3/2}}$$

(%i5) mvectdiff(G,r)=0;

(%o5) $0=0$

Potential

(%i6) P:-1/sqrt(-cnorm(r))/(4*%pi);

(P) $$-\frac{\frac{1}{4}}{\pi\sqrt{x^2+y^2+z^2}}$$

(%i7) mvectdiff(P,r)=G;

(%o7) $$\frac{e_1\,x+e_2\,y+e_3\,z}{\sqrt{x^2+y^2+z^2}\left(4\,\pi\,x^2+4\,\pi\,y^2+4\,\pi\,z^2\right)}=\frac{\frac{1}{4}\left(e_1\,x+e_2\,y+e_3\,z\right)}{\pi\left(x^2+y^2+z^2\right)^{3/2}}$$

Homogeneous Poisson equation

(%i8) dependsv(F,[x,y,z])$

(%i9) mvectdiff(F,r,2)=0;

(%o9) $$\frac{d^2}{d\,x^2}\,F+\frac{d^2}{d\,y^2}\,F+\frac{d^2}{d\,z^2}\,F=0$$

P solves the equation

(%i10) mvectdiff(P,r,2)=0;

(%o10) $0=0$

Define cyclindrical coordinates

(%i11) declare([rho, phi], scalar)$

(%i12) cyl_eq:[x=rho*cos(phi), y=rho*sin(phi)];

(cyl_eq) $[x=\cos(\varphi)\,\rho, y=\sin(\varphi)\,\rho]$

(%i13) r_c:coordsubst(r, cyl_eq);

(r_c) $(e_1\cos(\varphi)+e_2\sin(\varphi))\,\rho+e_3\,z$

Green function in cylindrical coordinates

(%i14) GG_c:coordsubst(G, cyl_eq),factor;

(GG_c) $$\frac{\frac{1}{4}\left(e_1\cos(\varphi)\,\rho+e_2\sin(\varphi)\,\rho+e_3\,z\right)}{\pi\left(\rho^2+z^2\right)^{3/2}}$$

(%i15) mvectdiff(GG_c,r_c)=0;

(%o15) $0=0$

(%i16) dependsv(F,[x,y,z,rho, phi])$

Homogeneous Poisson equation

(%i17) mvectdiff(F,r_c,2)=0;

(%o17) $$\frac{\frac{d^2}{d\,\varphi^2}F+\left(\frac{d}{d\,\rho}F\right)\rho+\left(\frac{d^2}{d\,\rho^2}F+\frac{d^2}{d\,z^2}F\right)\rho^2}{\rho^2}=0$$

(%i18) V:coordsubst(P,cyl_eq);

(V) $$-\frac{\frac{1}{4}}{\pi\sqrt{\rho^2+z^2}}$$

(%i19) mvectdiff(V,r_c)=GG_c;

(%o19) $$\frac{e_1\cos(\varphi)\,\rho+e_2\sin(\varphi)\,\rho+e_3\,z}{\sqrt{\rho^2+z^2}\left(4\,\pi\,\rho^2+4\,\pi\,z^2\right)}=\frac{\frac{1}{4}\left(e_1\cos(\varphi)\,\rho+e_2\sin(\varphi)\,\rho+e_3\,z\right)}{\pi\left(\rho^2+z^2\right)^{3/2}}$$

V solves the equation

(%i20) mvectdiff(V,r_c,2)=0;

(%o20) $0=0$

→ ;