

# wxMaxima Files

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Today

The files which start with 1 are for rectangular coordinates, 2 corresponds to cylindrical coordinates, 3 corresponds to spherical coordinates.

## 1 Rectangular coordinates

The most complete file is:

File: 1Pauli\_nabla3rect.wxm

Nablarect is the block that performs the nabla operator in rectangular coordinates. Gradesep performs the grade extraction. It is suggested to start from here.

The file

File: 1Example3.10rect.wxm

perform the gradient evaluation of a given function.

The file

File: 1Example3.11rect.wxm

perform the div and curl evaluation of a given vector. Conventional analysis is also used.

The file

File: 1Gradient\_rectangular.wxm

perform the gradient evaluation of a given function with Pauli matrices.

The file

File: 1nabla\_rectangular.wxm

perform the div and curl evaluation of a given vector with Pauli matrices.

## 2 Cylindrical coordinates

### 2.1 Cylindrical Potential

The most complete file is the following:

File: Nabla\_cyl\_4\_blocks.wxm

This file contains a block performing the nabla operator in cylindrical coordinates. It also contains the Pauli matrices for rectangular and cylindrical coordinates. It also contains a block Gradecyl which perform the grade operation in cylindrical coordinates.

At the end there are two examples. The first example deals with a charged line (Electrostatic field) The second example deals with an infinite filament with current.

## 2.2 Conventional and GA nabla for cylindrical coordinates

File: 2Nabla\_cyl.wxm

This files shows how to the div , grad curl operation in conventional analysis and with Pauli matrices.

## 2.3 example 3.10, exercise 3.10, exercise 3.13

File: Esempio\_3.10.wxm

This file contains a block performing the nabla operator in cylindrical coordinates. It also contains the Pauli matrices for rectangular and cylindrical coordinates.

It solves the example 3.10 of Ulaby which for a scalar function

$$V = V_0 e^{-2\rho} \sin(3\phi) \quad (1)$$

ask to evaluate the gradient. Then performs the divergence and the curl in cylindrical coordinates.

## 3 Spherical coordinates: Dipole

The most complete file is

File: 3Nabla\_sph\_2\_blocks.wxm

which contains a block for the nabla evaluation in spherical coordinates and a block for the grade retrieval.

The file

File: 3Nabla\_sph\_exc\_2.wxm

is an example for a particular vector.

File: Dipole\_sph\_1.wxm

This file contains a block performing the nabla operator in spherical coordinates. It also contains the Pauli matrices for rectangular and spherical coordinates.

We assume a potential of the type

$$\frac{e^{-jkr}}{r} \mathbf{z}_0 \quad (2)$$

which is the same of a short dipole. Perform the nabla operator on this potential.

This file also contains a block Gradesph that performs the grade extraction.

The Electric field is evaluated from the potential as

$$\begin{aligned} \Phi &= -\frac{v}{jk} \nabla \cdot \mathbf{A} \\ \mathbf{E} &= -jkv \mathbf{A} - \nabla \Phi \end{aligned}$$