

# **GNU/Linux, software libre para la comunidad universitaria**

## **Software científico en GNU/Linux**

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<b>COLABORADORES</b>
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# Capítulo 1

## Introducción

El software libre siempre ha estado muy ligado a las universidades y el mundo académico. Por este motivo, es fácil encontrar muchos programas libres dentro del ámbito científico.

El propósito de este documento es mostrar las principales aplicaciones libres que puedan resultar útiles a un científico o ingeniero.

Adjunto a este documento, se aportan manuales que enseñan a utilizar algunos de los programas descritos. Es digno de recalcar que parte de dicha documentación se generó con motivo del curso extraordinario *Herramientas en GNU/Linux para estudiantes universitarios* que se celebró en la Universidad de Salamanca y que fue organizado por el Departamento de Informática y Automática, AUGCyL, GLiSa, la Asociación de Estudiantes Miguel de Unamuno y la Delegación de Alumnos de la Facultad de Ciencias.

La mayoría del software científico que podemos encontrar en GNU/Linux sigue la filosofía de desarrollo del mundo Unix, según la cual se favorece la creación de pequeñas herramientas muy específicas y potentes que funcionan a través de la línea de comandos. Gracias a este modelo de desarrollo, es posible una fácil interacción entre ellas y la posibilidad de creación de diferentes interfaces gráficas a partir de un esfuerzo común.

Como ya se ha dicho, aquí se mostrarán las aplicaciones que los autores han considerado más importantes; no obstante, para encontrar programas que respondan a necesidades más específicas, puede:

- Visitar recopilaciones de software como el [directorio de software libre de la FSF y la UNESCO](#) o [Scientific Applications on Linux](#).
  - Examinar los repositorios de una distribución GNU/Linux (suelen estar organizados por categorías).
  - Utilizar buscadores de Internet.
-

## Capítulo 2

# Procesadores de texto

### 2.1. TeX

**TeX** es un sistema de tipografía creado por Donald E. Knuth en 1978.

Su aparición supuso un hito en la composición de fórmulas matemáticas.

Su complejidad ha hecho que surjan soluciones de alto nivel basadas en él y que conservan sus bondades.

Posee una gran cantidad de complementos que se pueden encontrar en la red **CTAN**.

De manera similar a lo que ocurre con GNU/Linux, TeX y el resto de programas basados en él se distribuyen empaquetados en distribuciones que facilitan su instalación. Las más importantes son:

- **teTeX**

Es una distribución de TeX para GNU/Linux. El desarrollo de teTeX sido abandonado por su autor, aunque todavía forma parte de algunas distribuciones.

- **TeX Live**

TeX Live es una distribución de TeX para GNU/Linux. Ha sustituido a teTeX en la mayoría de distribuciones GNU/Linux.

- **MacTeX**

Es una distribución de TeX para Mac OS X.

- **MiKTeX**

Es una distribución de TeX para Microsoft Windows.

- **proTeXt**

Es una distribución de TeX para Microsoft Windows basada en MiKTeX. Su objetivo es dotar a MiKTeX de un proceso de instalación sencillo.

También es importante destacar que existen comunidades de usuarios de TeX y sus variantes que favorecen su difusión y aprendizaje. Una de ellas que podría interesar al lector es **CervanTeX**, pues se centra en la comunidad hispanohablante.



Figura 2.1: Logotipo de TeX

## 2.1.1. LaTeX

**LaTeX** es un sistema de preparación de documentos basado en TeX y el lenguaje de marcado utilizado en el mismo. En concreto, es un conjunto de macros de TeX.

Fue creado por Leslie Lamport en 1984.

En la actualidad es un estándar de facto en las revistas científicas.<sup>1</sup>



Figura 2.2: Logotipo de LaTeX

### 2.1.1.1. Texmaker

**Texmaker** es un editor de texto diseñado para facilitar la producción y procesamiento de archivos LaTeX.

Es una aplicación multiplataforma disponible para GNU/Linux, Microsoft Windows y Mac OS.

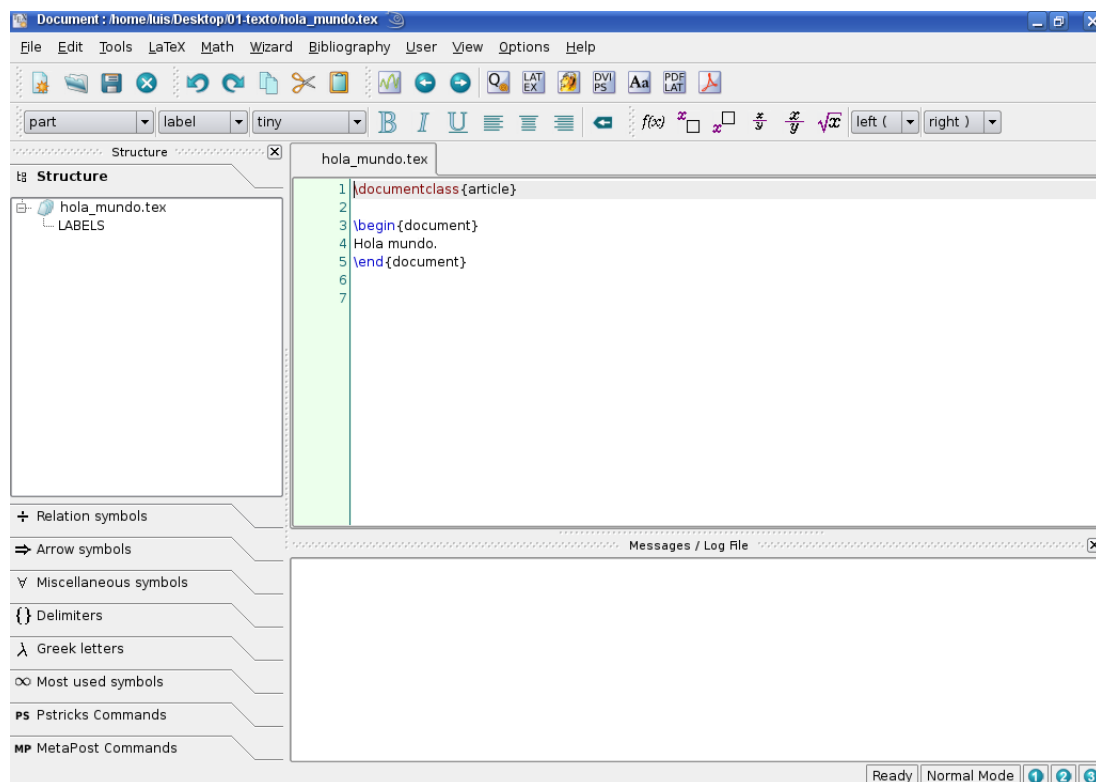


Figura 2.3: Texmaker

1

- Información general para los autores de la Sociedad Matemática Americana
- Directrices de entrega de artículos de Physical Review

### 2.1.1.2. Kile

**Kile** es el editor de texto del proyecto KDE pensado para ser utilizado en la creación de documentos TeX o LaTeX.

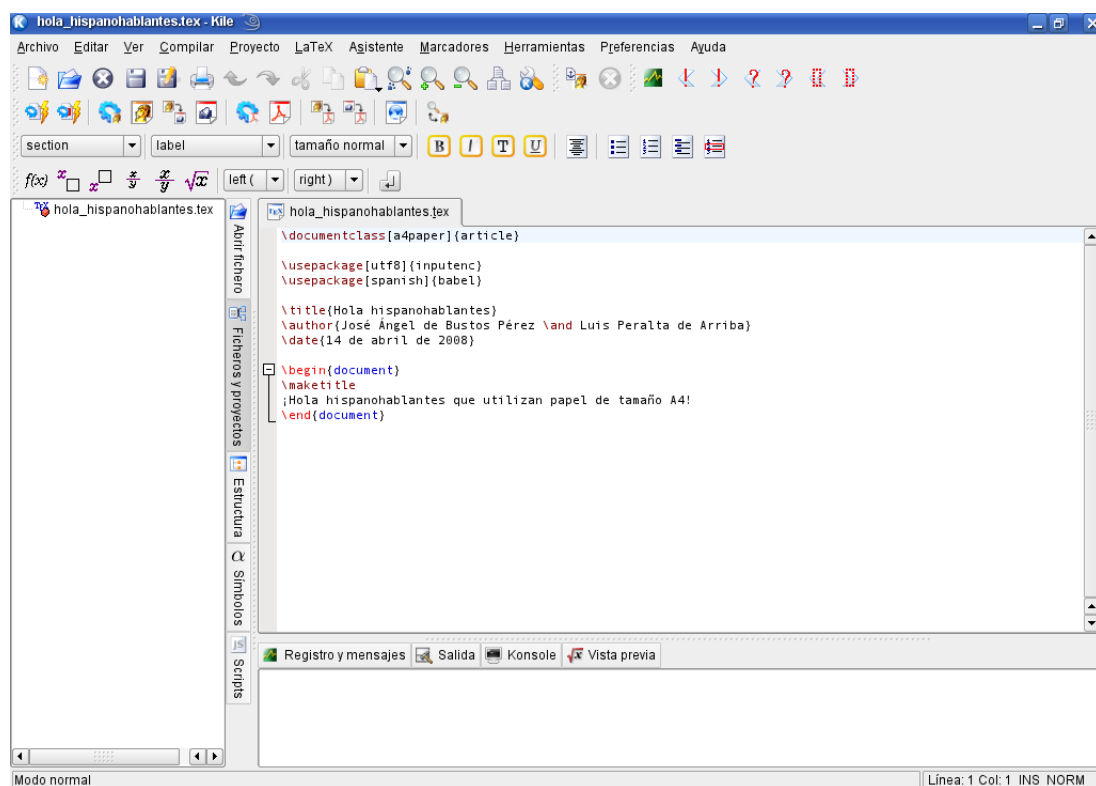


Figura 2.4: Kile

## 2.2. GNU TeXmacs

**GNU TeXmacs** es un editor WYSIWYG (lo que ves es lo que consigues) especializado en textos científicos.

GNU TeXmacs es capaz de ejecutar de manera integrada a aplicaciones como gnuplot, Maxima, GNU Octave...

Es una aplicación multiplataforma disponible para GNU/Linux, Microsoft Windows y Mac OS entre otros.

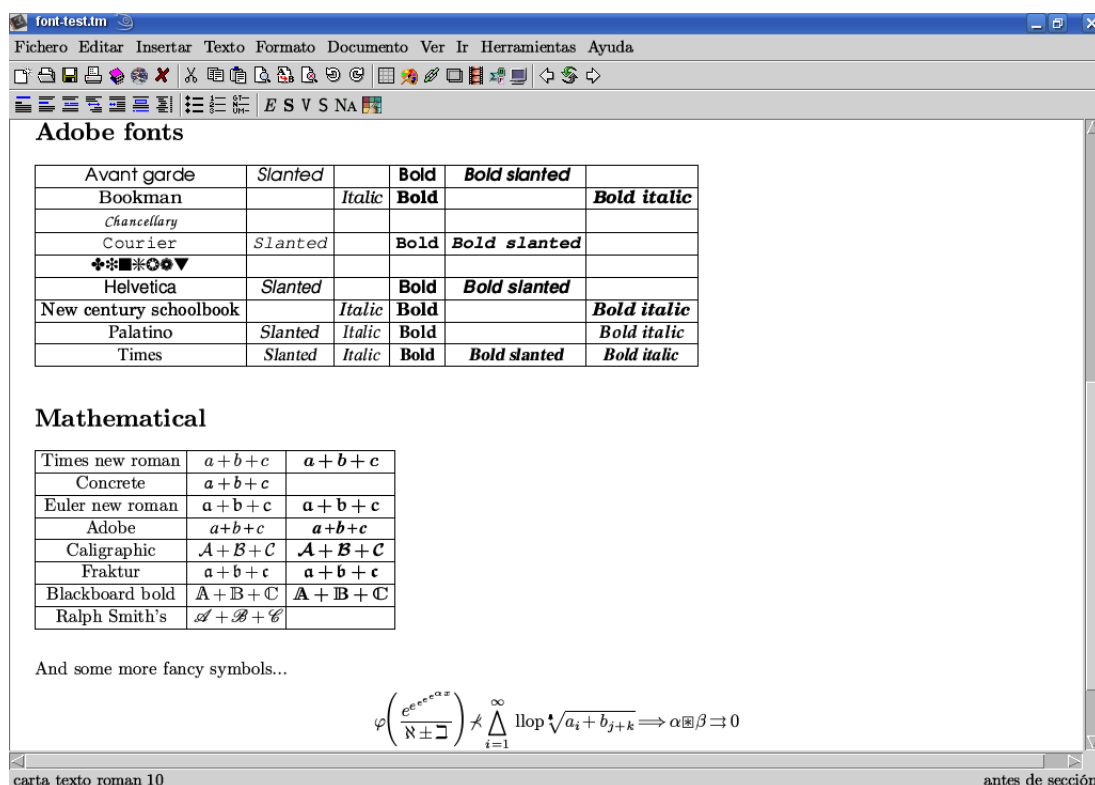


Figura 2.5: GNU TeXmacs

## 2.3. LyX

**LyX** es un procesador de texto gráfico basado en el modelo WYSIWYM (lo que ves es lo que quieres decir). Esto significa que el autor sólo se debe preocupar de la estructura y contenido del texto, ya que el programa se encarga de la presentación.

La potencia de LyX radica en que combina la potencia de LaTeX con la facilidad de uso de una interfaz gráfica.

Es una aplicación multiplataforma disponible para GNU/Linux, Microsoft Windows y Mac OS.

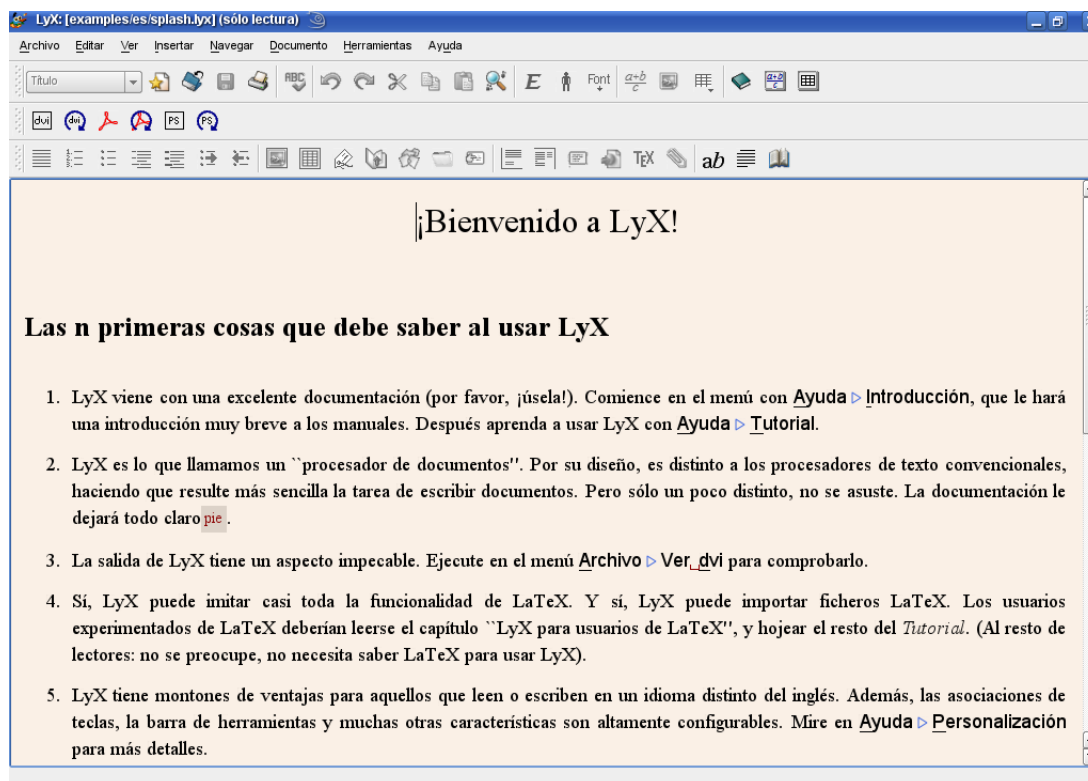


Figura 2.6: LyX

## 2.4. OpenOffice.org Math

**OpenOffice.org Math** es el editor de ecuaciones de la suite ofimática OpenOffice.org.

Aparece en esta recopilación por su capacidad para exportar las ecuaciones en formato MathML, que es el estándar para incluir expresiones matemáticas en páginas web.

Es una aplicación multiplataforma disponible para GNU/Linux, Microsoft Windows y Mac OS entre otros.

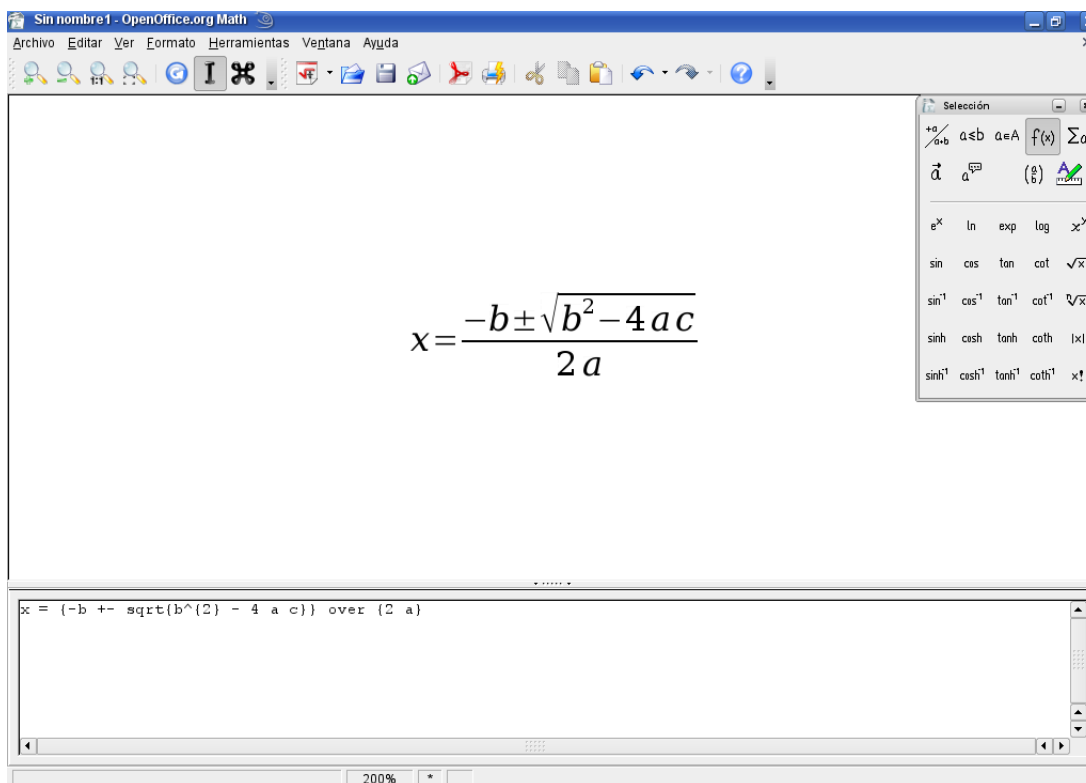


Figura 2.7: OpenOffice.org Math

## Capítulo 3

# Creación de gráficos

### 3.1. Representación de funciones y datos

#### 3.1.1. gnuplot

**gnuplot** es un programa interactivo para la visualización de funciones y datos, aunque también soporta usos no interactivos.

Soporta tanto gráficos bidimensionales como tridimensionales. Puede dibujar líneas, puntos, cajas, contornos, campos vectoriales, superficies, varios tipos de textos asociados...

La principal virtud que hace especial a este programa es la cantidad de formatos de salida con los que cuenta. Entre ellos destacan LaTeX, EPS, PDF, METAFONT, SVG, PNG...

Es una aplicación multiplataforma disponible para GNU/Linux, Microsoft Windows y Mac OS entre otros.

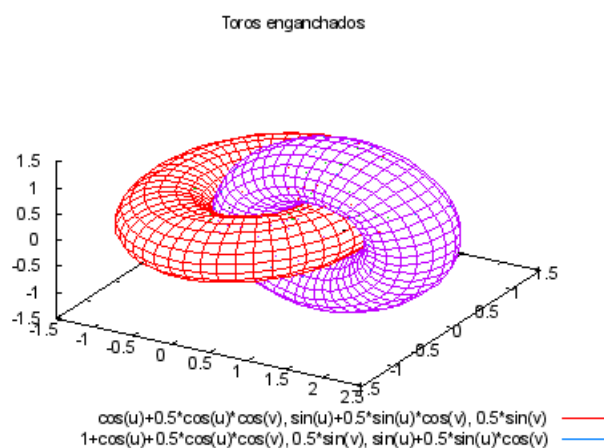


Figura 3.1: Gráfico generado con gnuplot

##### 3.1.1.1. Qgfe

**Qgfe** es una interfaz gráfica para gnuplot.



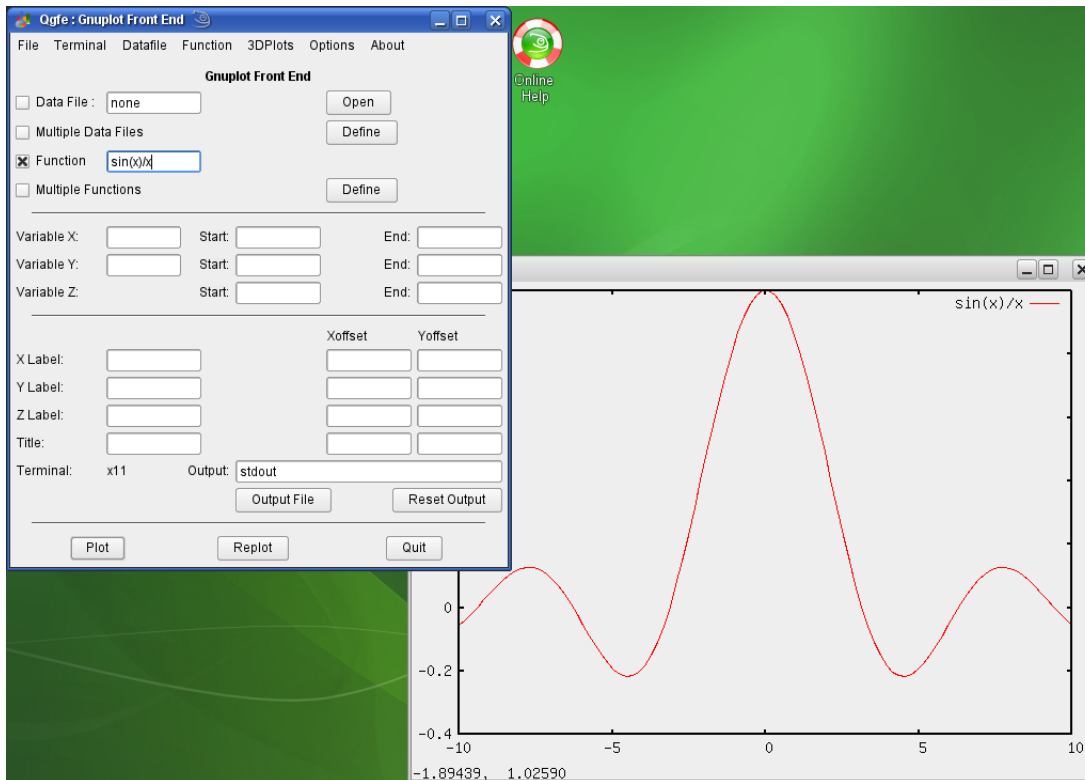


Figura 3.2: Qgfe

## 3.2. Diagramas

### 3.2.1. Dia

**Dia** es un programa para la creación de diagramas.

Está inspirado en la aplicación privativa Visio.

Es una aplicación multiplataforma disponible para GNU/Linux y Microsoft Windows.

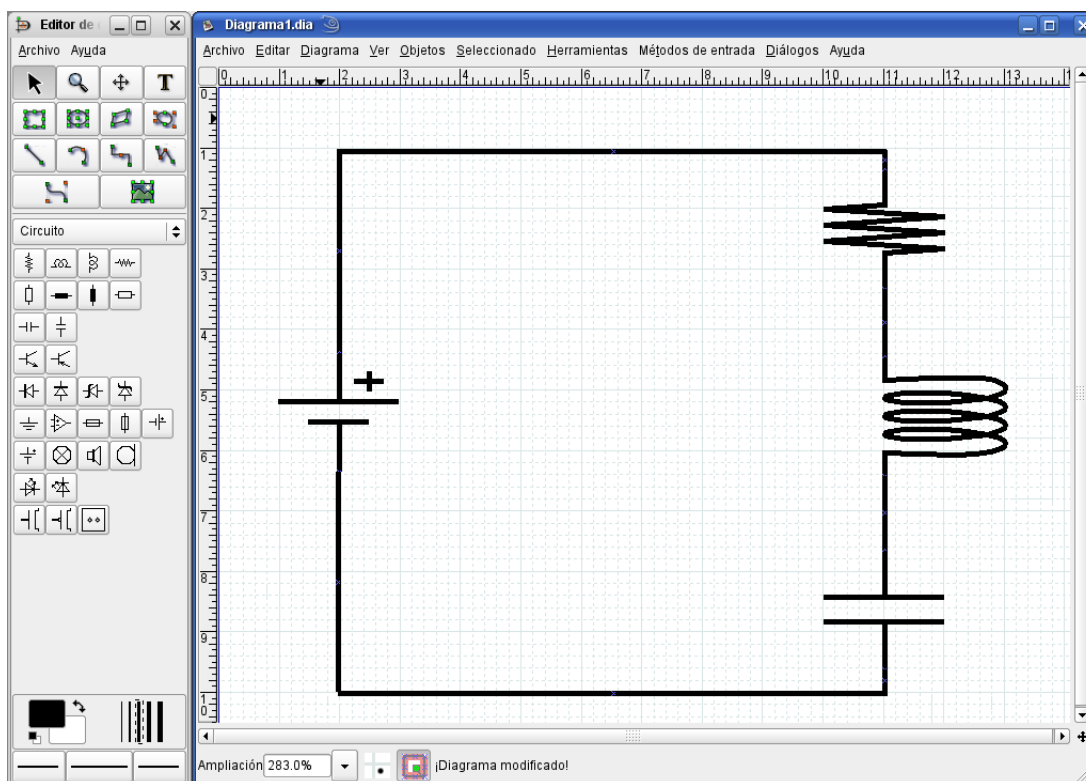


Figura 3.3: Dia

### 3.2.2. Xfig

**Xfig** es una programa para dibujar esquemas.

Es una aplicación multiplataforma disponible para GNU/Linux, Microsoft Windows y Mac OS.

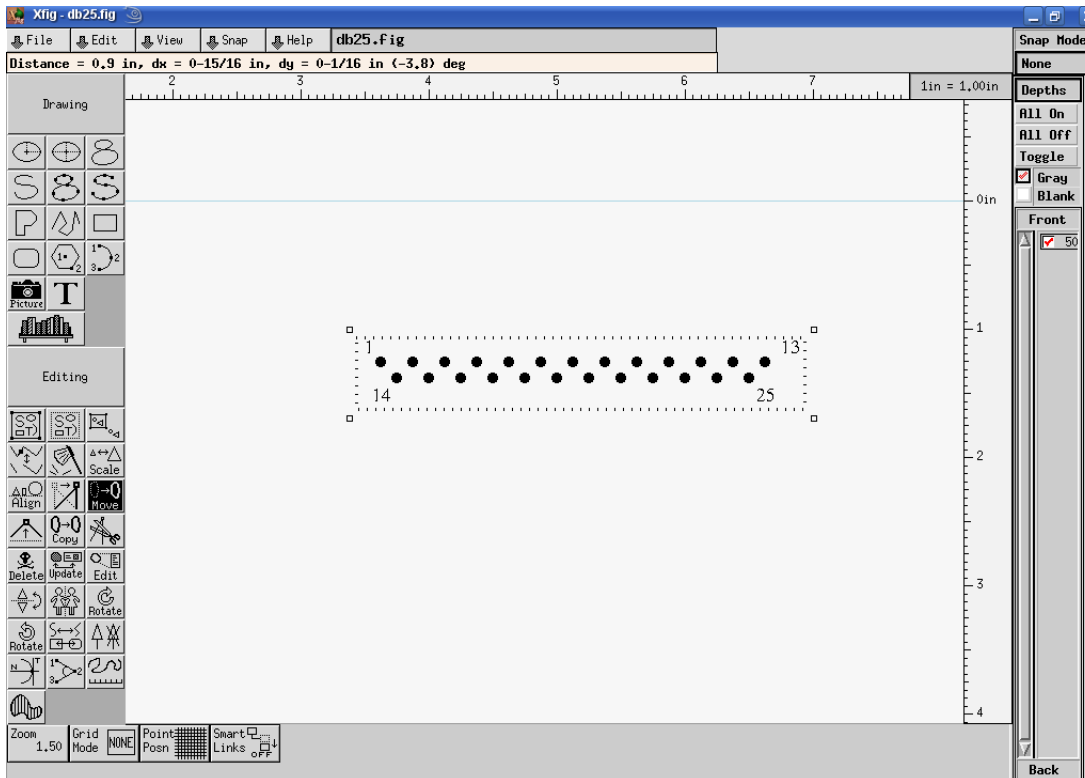


Figura 3.4: Xfig

### 3.3. Dibujos geométricos

#### 3.3.1. GeoGebra

**GeoGebra** es un sistema de geometría dinámica.

Puede hacer construcciones con puntos, vectores, segmentos, secciones cónicas, funciones...

Es una aplicación multiplataforma disponible para GNU/Linux, Microsoft Windows y Mac OS entre otros.

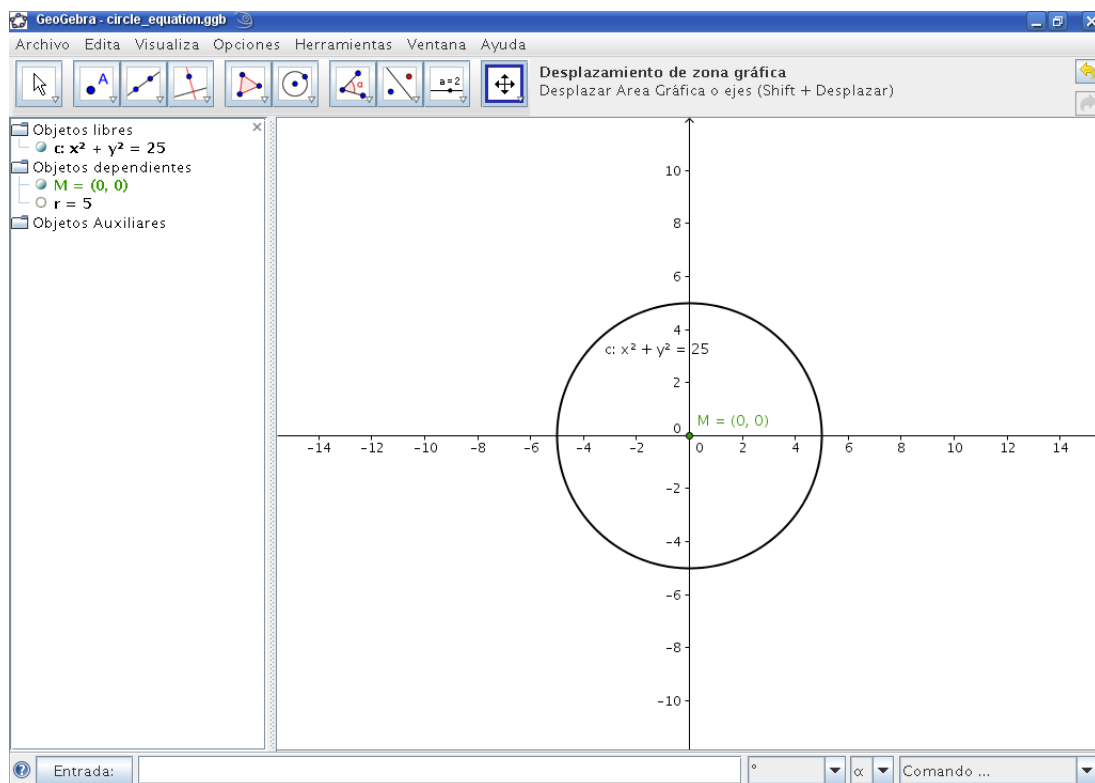


Figura 3.5: GeoGebra

### 3.3.2. GEONExT

**GEONExT** es un programa para hacer dibujos geométricos que pueden ser animados.

Es una aplicación multiplataforma disponible para GNU/Linux, Microsoft Windows y Mac OS.

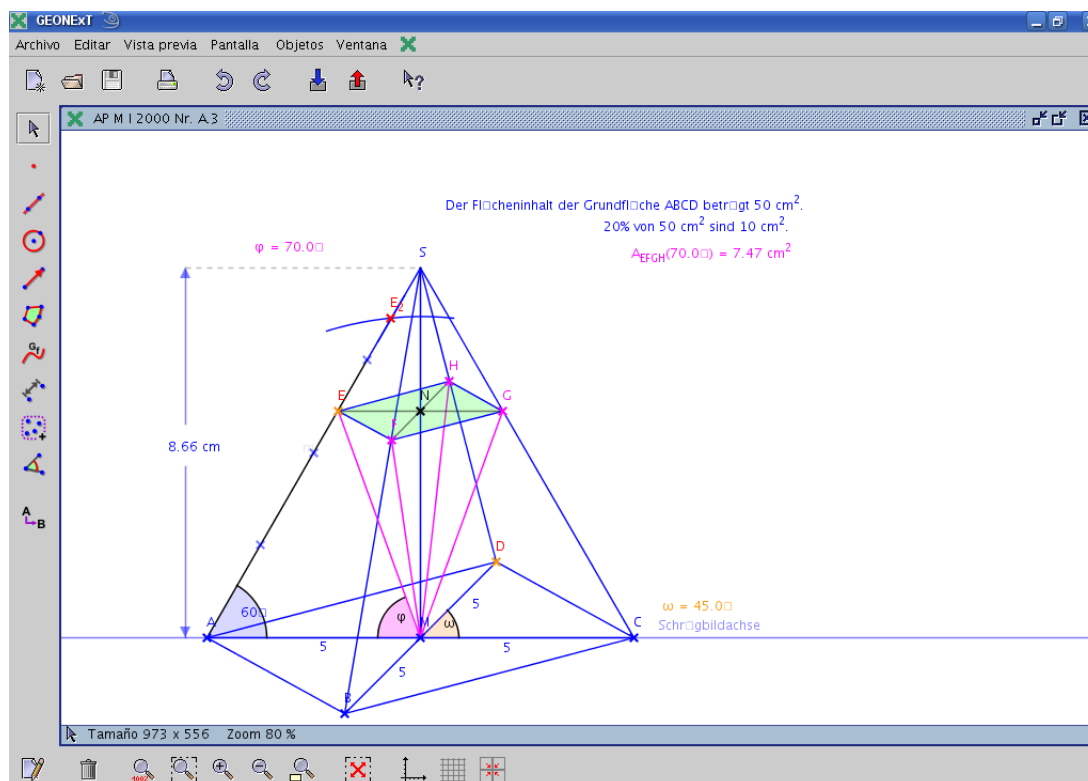


Figura 3.6: GEONExT

## 3.4. Visualización de estructuras químicas

### 3.4.1. GDIS

**GDIS** es un visor y manipulador de moléculas aisladas y sistemas periódicos.

Es una aplicación multiplataforma disponible para GNU/Linux, Microsoft Windows y Mac OS entre otros.

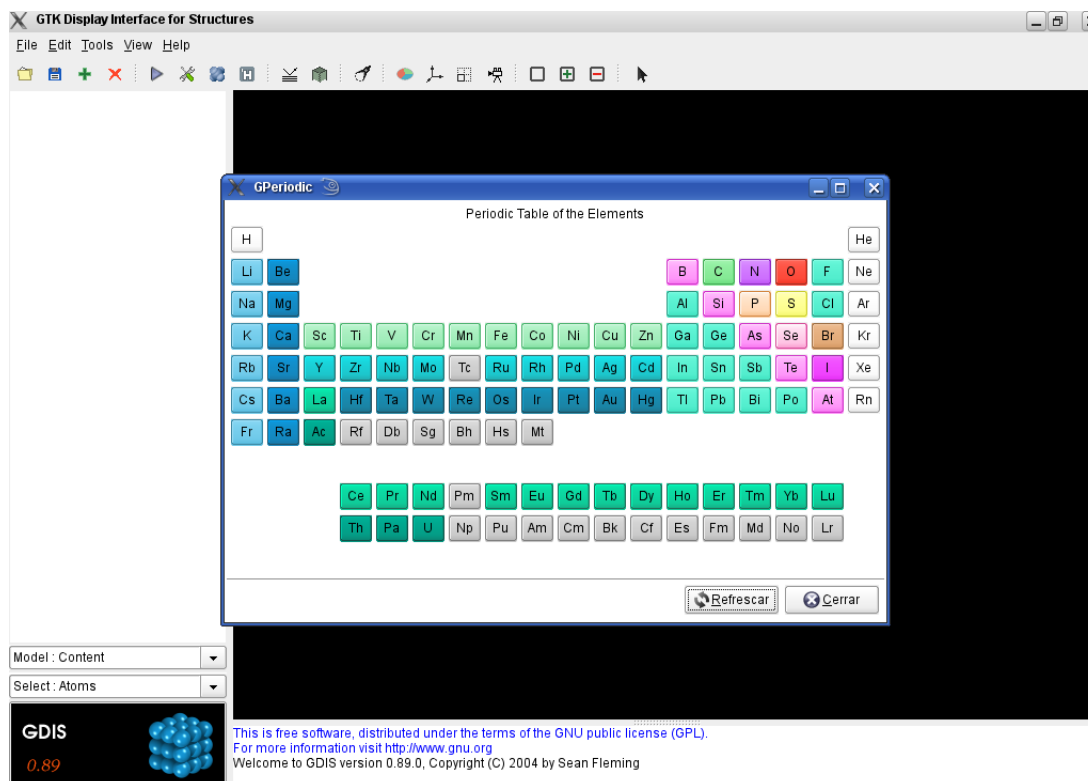


Figura 3.7: GDIS

### 3.4.2. Chemtool

**Chemtool** es un pequeño programa para dibujar estructuras químicas.

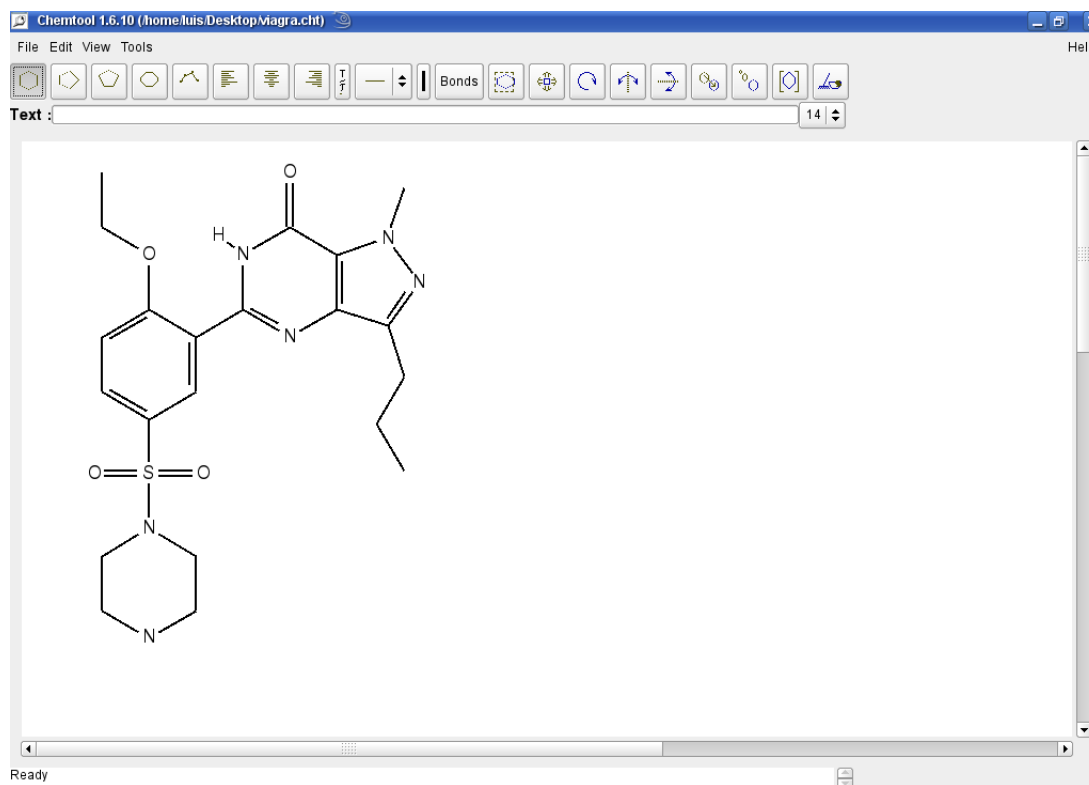


Figura 3.8: Chemtool

### 3.4.3. Garlic

Garlic es un visor y editor molecular.

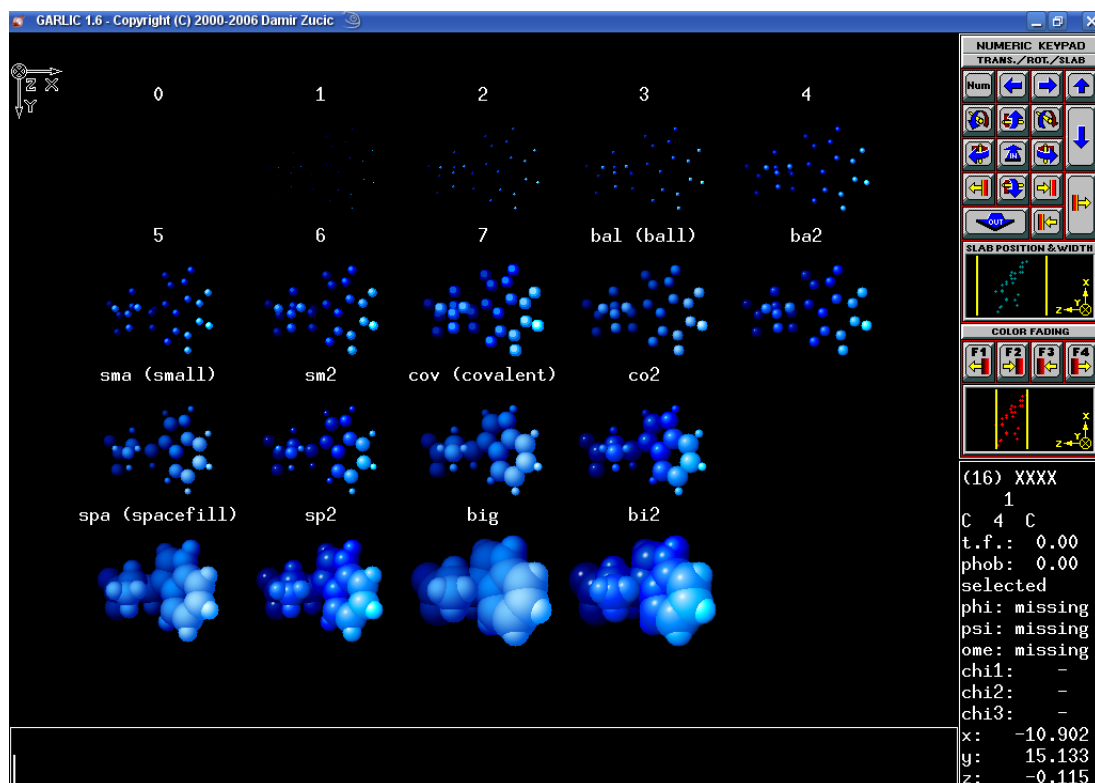


Figura 3.9: Garlic



## Capítulo 4

# Cálculo simbólico

### 4.1. Maxima

**Maxima** es un sistema para la manipulación de expresiones simbólicas y numéricas, incluyendo diferenciación, integración, expansión en series de Taylor, transformadas de Laplace, ecuaciones diferenciales ordinarias, sistemas de ecuaciones lineales, vectores, matrices y tensores.

Produce resultados con alta precisión usando fracciones exactas y representaciones con aritmética de coma flotante arbitraria.

También puede realizar gráficas interaccionando con otros programas como gnuplot.

Es una aplicación multiplataforma disponible para GNU/Linux, Microsoft Windows y Mac OS.

#### 4.1.1. wxMaxima

**wxMaxima** es una interfaz de Maxima basada en las bibliotecas wxWidgets.

Es una aplicación multiplataforma disponible para GNU/Linux y Microsoft Windows.

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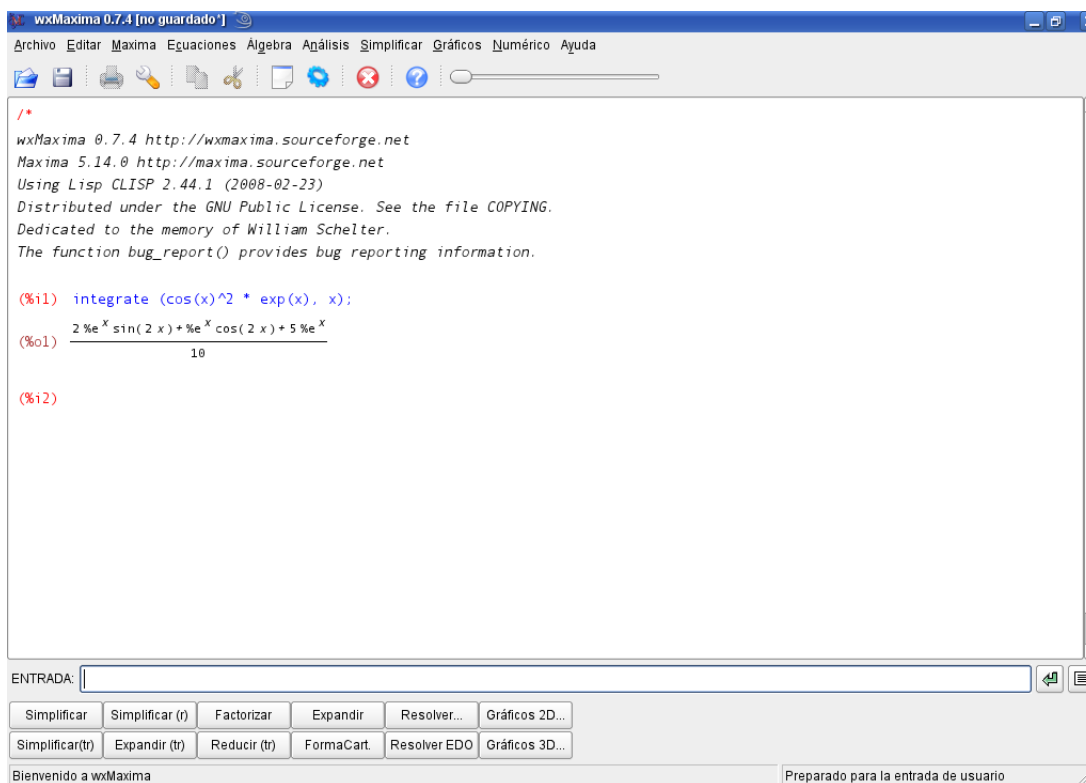


Figura 4.1: wxMaxima

#### 4.1.2. Xmaxima

**Xmaxima** es una interfaz de Maxima creada utilizando Tcl/Tk.

Es una aplicación multiplataforma disponible para GNU/Linux, Microsoft Windows y Mac OS.

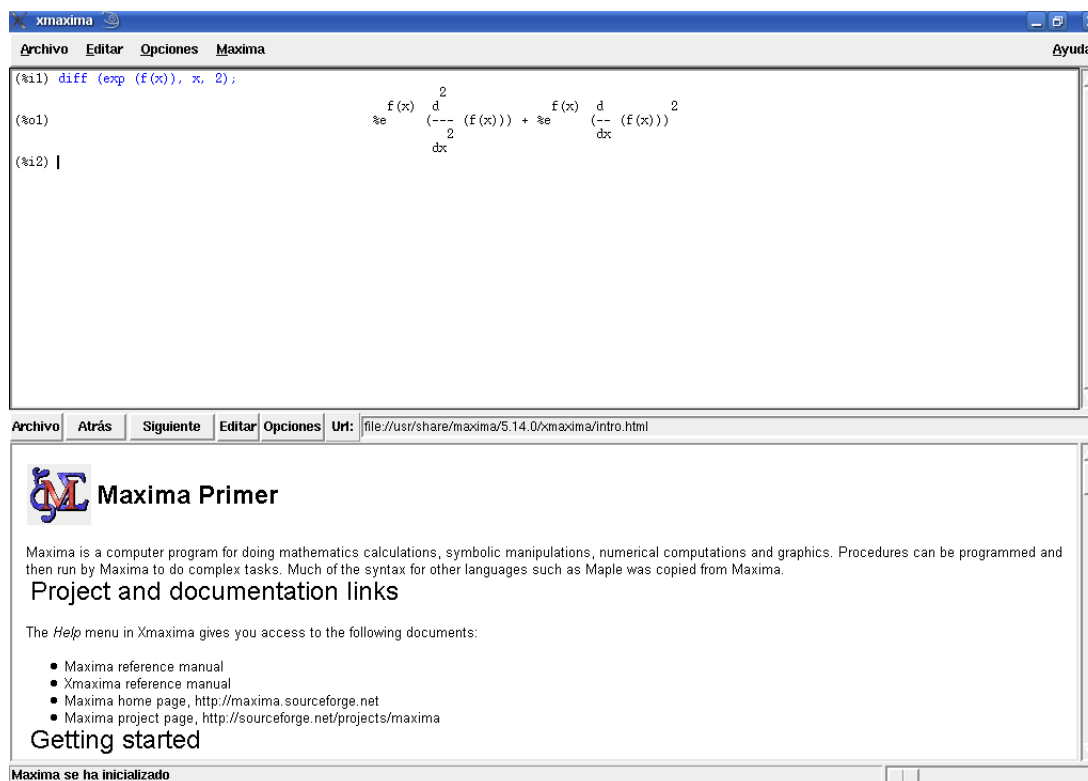


Figura 4.2: Xmaxima

## 4.2. Yacas

**Yacas** es un sistema de Álgebra Computacional de propósito general para la manipulación simbólica de expresiones matemáticas. Es una aplicación multiplataforma disponible para GNU/Linux y Microsoft Windows.

## 4.3. Axiom

**Axiom** es un sistema de Álgebra Computacional de propósito general. Es una aplicación multiplataforma disponible para GNU/Linux y Mac OS.

## Capítulo 5

# Cálculo numérico

### 5.1. GNU Octave

**GNU Octave** es un programa de línea de comandos y un lenguaje de alto nivel, diseñado principalmente para realizar cálculos numéricos que forma parte del proyecto GNU.

Tiene una sintaxis altamente compatible con la del programa privativo MATLAB.

Desde la línea de comandos de GNU Octave se pueden generar gráficos de funciones y datos, aunque conviene saber que para ello utiliza herramientas externas como gnuplot.

Es una aplicación multiplataforma disponible para GNU/Linux, Microsoft Windows y Mac OS entre otros.

#### 5.1.1. QtOctave

**QtOctave** es una interfaz gráfica que tiene como objetivo facilitar el trabajo con GNU Octave mediante ventanas, menús y asistentes.

QtOctave ganó el premio de primer finalista del I Concurso Universitario de Software Libre en la categoría de ocio y educación.

Es una aplicación multiplataforma disponible para GNU/Linux y Microsoft Windows.

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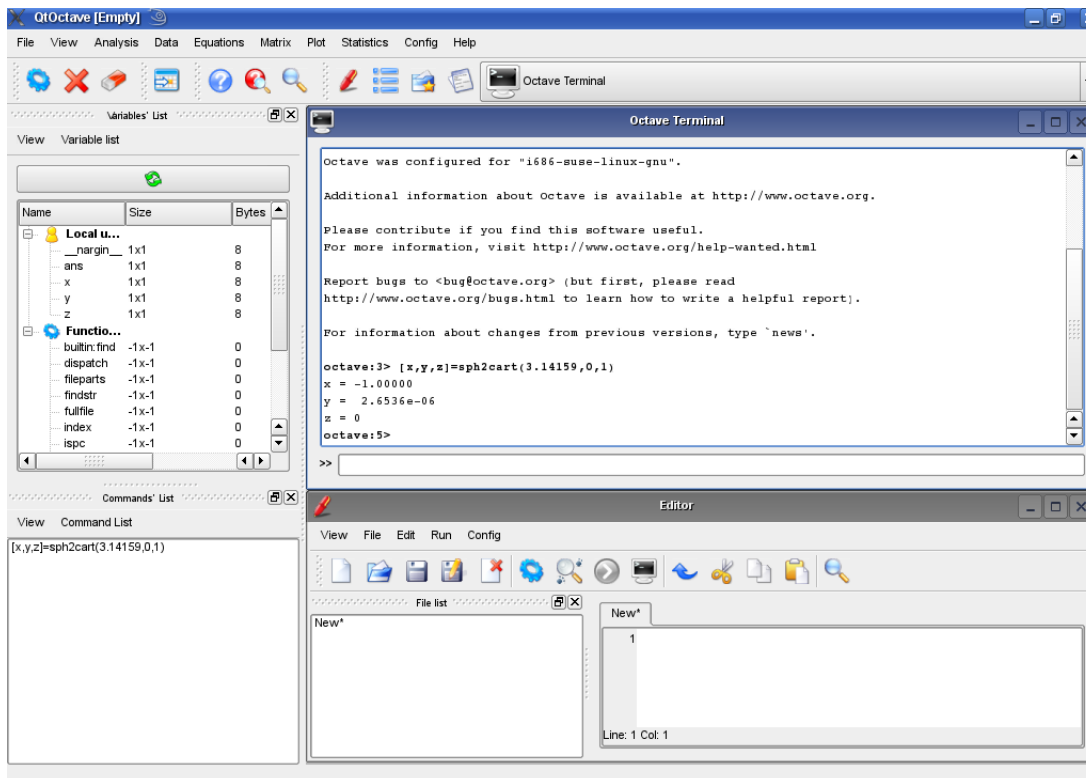


Figura 5.1: QtOctave

## 5.2. FreeMat

**FreeMat** es un entorno para científicos e ingenieros que se dedican al modelado y procesamiento de datos.

Su sintaxis es altamente compatible con la del sistema privativo MATLAB.

Es una aplicación multiplataforma disponible para GNU/Linux, Microsoft Windows y Mac OS.

```
--> a = float([1,2,3;4,5,8;10,12,3])

a =

   1   2   3
   4   5   8
  10  12   3

--> [1,u,p] = lu(a)

l =

   1.0000   0   0
   0.1000   1.0000   0
   0.4000   0.2500   1.0000

u =

  10.0000  12.0000   3.0000
         0   0.8000   2.7000
         0   0   6.1250

p =

   0   0   1
   1   0   0
   0   1   0

--> l*u

ans =

  10  12   3
   1   2   3
   4   5   8

-->
```

Figura 5.2: FreeMat

## Capítulo 6

# Análisis estadístico

### 6.1. R

**R** es un entorno y lenguaje de programación para análisis estadístico y gráfico.

Se trata de una implementación libre del premiado lenguaje S.

Es una aplicación multiplataforma disponible para GNU/Linux, Microsoft Windows y Mac OS entre otros.

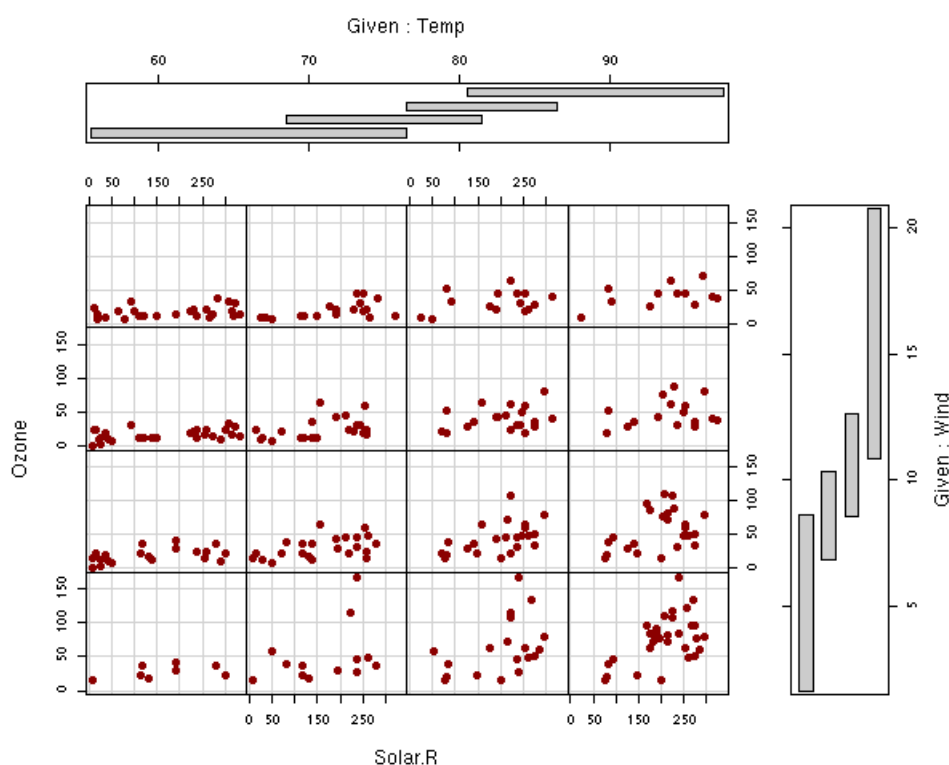


Figura 6.1: Gráfico generado con R

## Capítulo 7

# Diseño asistido por computador o CAD

### 7.1. QCad

**QCad** es una aplicación para dibujo asistido por ordenador en dos dimensiones.

Con QCad se pueden crear dibujos técnicos como planos para edificios, interiores, piezas mecánicas o esquemas.

Es una aplicación multiplataforma disponible para GNU/Linux, Microsoft Windows y Mac OS entre otros.

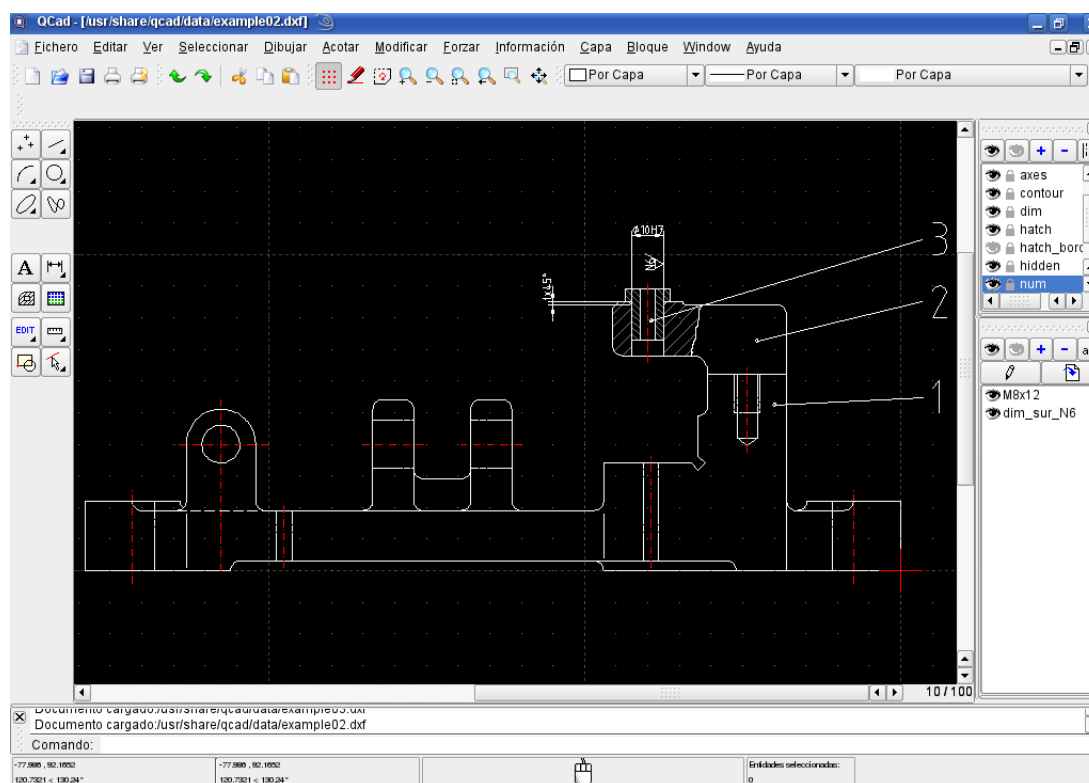


Figura 7.1: QCad

### 7.2. PythonCAD

**PythonCAD** es un CAD escrito sólo y sorprendentemente con el lenguaje de programación Python.



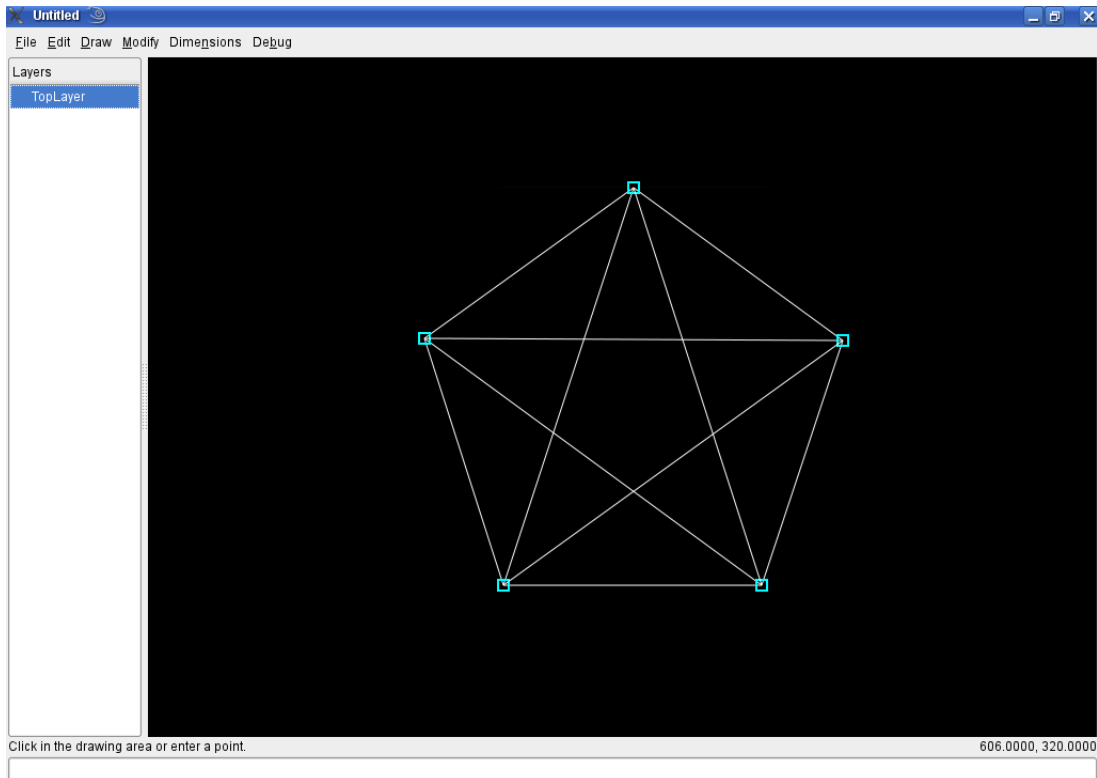


Figura 7.2: PythonCAD

## Capítulo 8

# Sistemas de información geográfica o GIS

### 8.1. GRASS

**GRASS** es un sistema de información geográfica que forma parte de los proyectos oficiales de la **Fundación para el Código Abierto Geoespacial**.

Soporta información tanto raster como vectorial y posee herramientas de procesamiento digital de imágenes.

Es una aplicación multiplataforma disponible para GNU/Linux, Microsoft Windows y Mac OS.

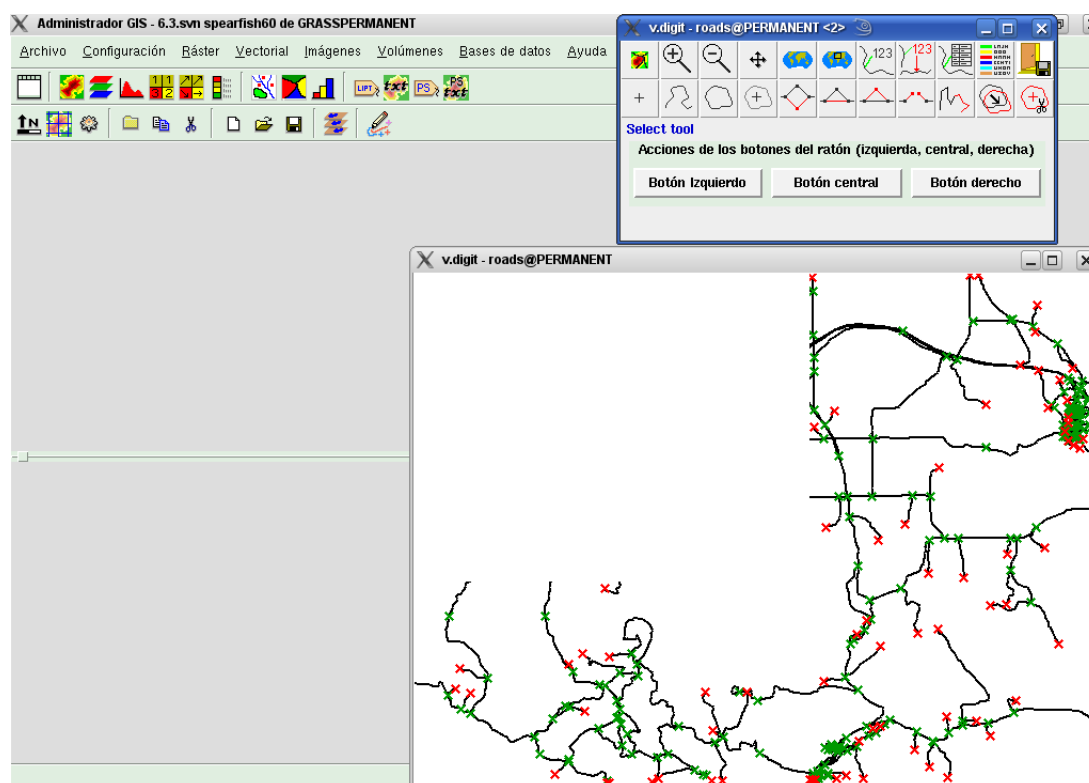


Figura 8.1: GRASS

## Capítulo 9

# Circuitos eléctricos

### 9.1. Logisim

**Logisim** es una herramienta educativa para el diseño y la simulación de circuitos lógicos digitales.

Aunque cuenta con una interfaz muy sencilla, Logisim puede ser usado (y es usado) para diseñar y simular completas unidades centrales de procesamiento con propósitos educativos.

Es una aplicación multiplataforma disponible para GNU/Linux, Microsoft Windows y Mac OS entre otros.

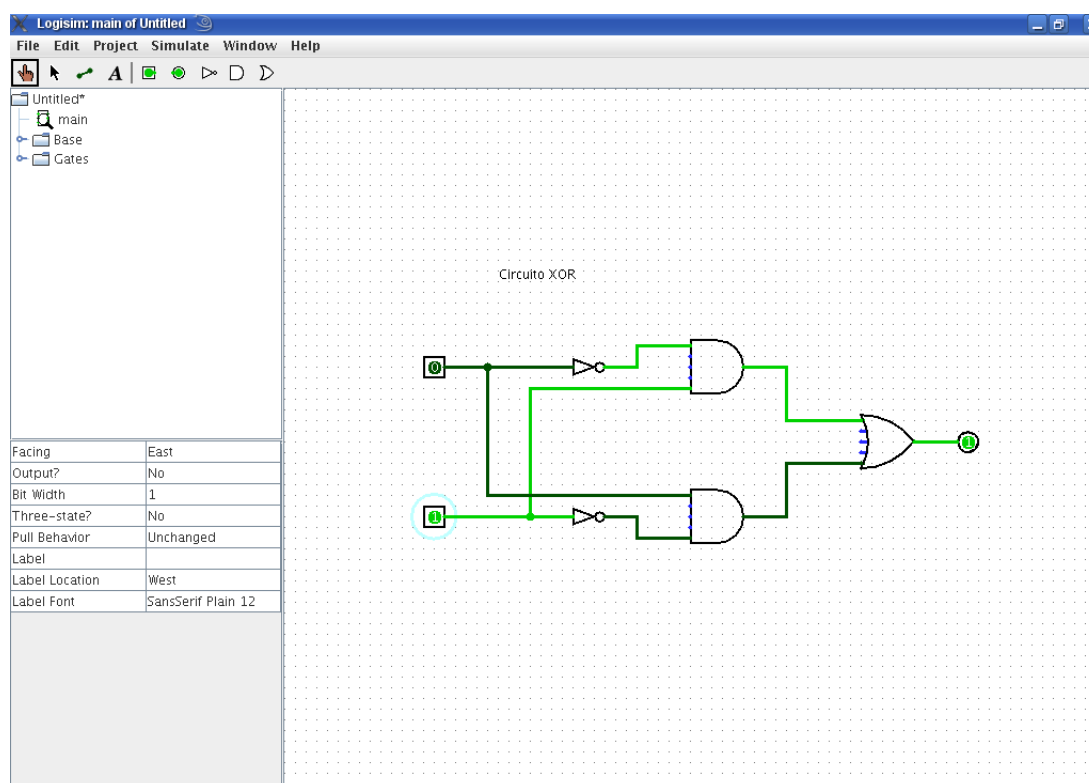


Figura 9.1: Logisim

## 9.2. KiCad

**KiCad** es un programa de automatización del diseño electrónico (EDA).

KiCad se compone de un gestor de proyectos que interacciona con cuatro programas principales:

- El editor de esquemas eeschema.
- El selector de componentes usados en el diseño del circuito cvpcb.
- El programa editor de circuitos impresos pcbnew.
- El visor Gerber gerbview.

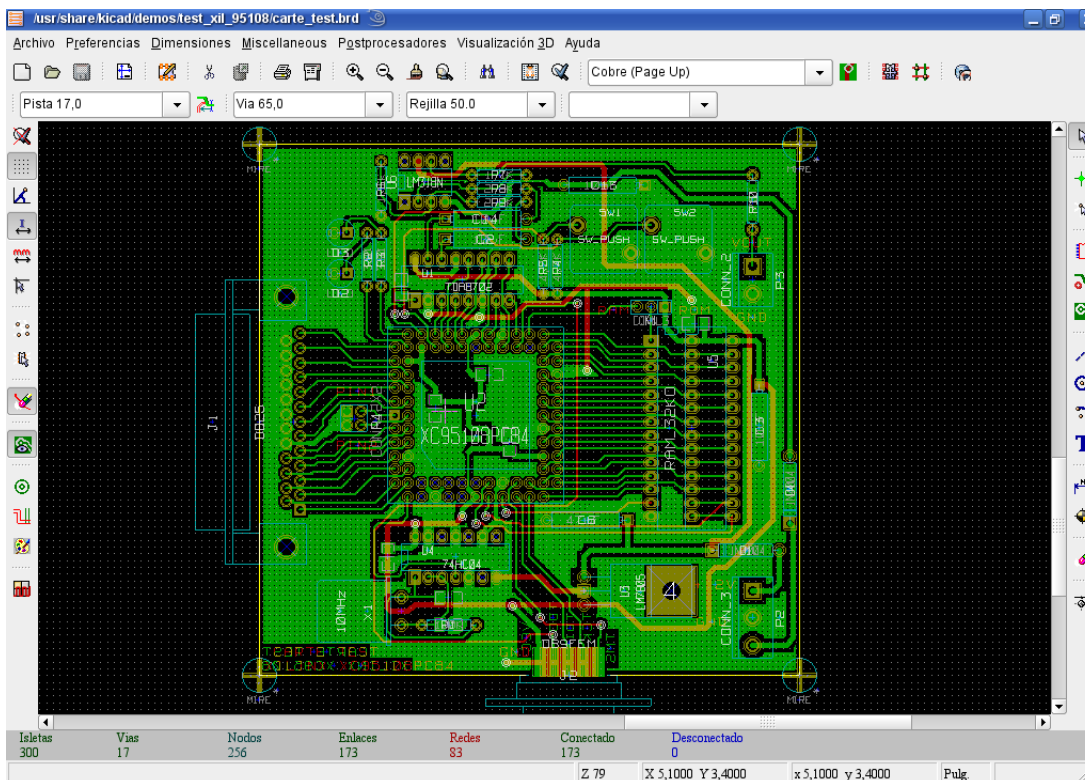


Figura 9.2: KiCad

## Capítulo 10

# Tabla periódica de los elementos

### 10.1. Kalzium

**Kalzium** es una aplicación que muestra la tabla periódica de los elementos.

Además de los datos comunes que aparecen en las tablas impresas, dispone de otros tales como el punto de fusión, la afinidad electrónica, el radio covalente, el origen del nombre...

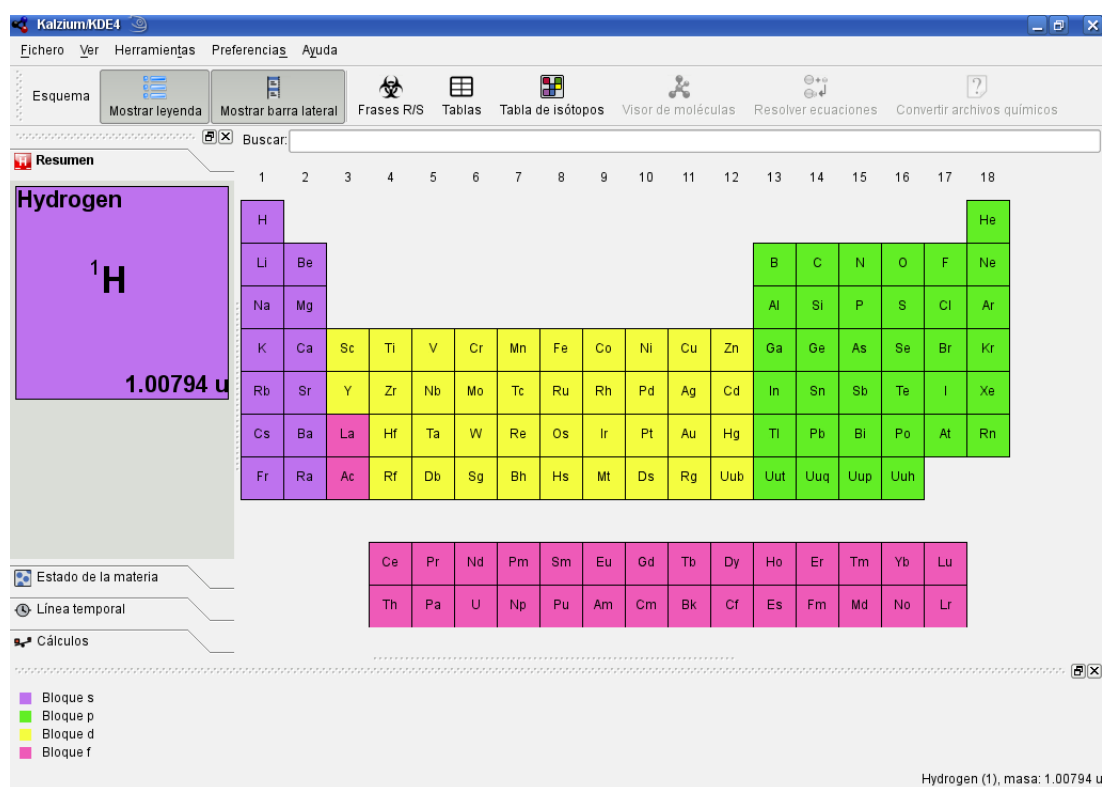


Figura 10.1: Kalzium

## Capítulo 11

# Simulación astronómica

### 11.1. Celestia

**Celestia** es un simulador espacial tridimensional, que al contrario que la mayoría de software astronómico no nos confina a la superficie de la Tierra.

Es un programa que ha sido utilizado por la NASA y la Agencia Espacial Europea. <sup>1</sup>

Es una aplicación multiplataforma disponible para GNU/Linux, Microsoft Windows y Mac OS.

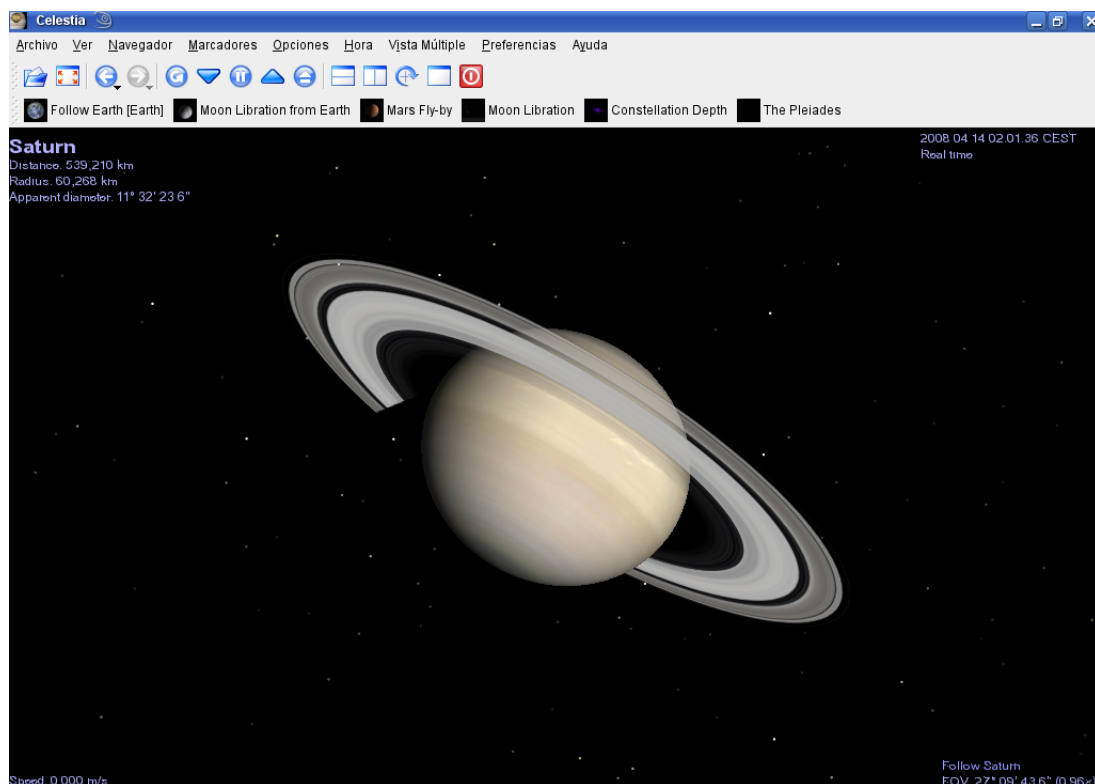


Figura 11.1: Celestia

<sup>1</sup>

- [Proyecto de enseñanza de Celestia de la NASA](#)
- [Noticia de la Agencia Espacial Europea ilustrada con Celestia](#)

## 11.2. KStars

**KStars** es el planetario del proyecto KDE.

Ofrece una simulación precisa del cielo nocturno para cualquier localización terrestre a la fecha y hora deseadas. La representación incluye 130.000 estrellas, 13.000 objetos del cielo profundo, el Sol, la Luna y miles de cometas y asteroides.

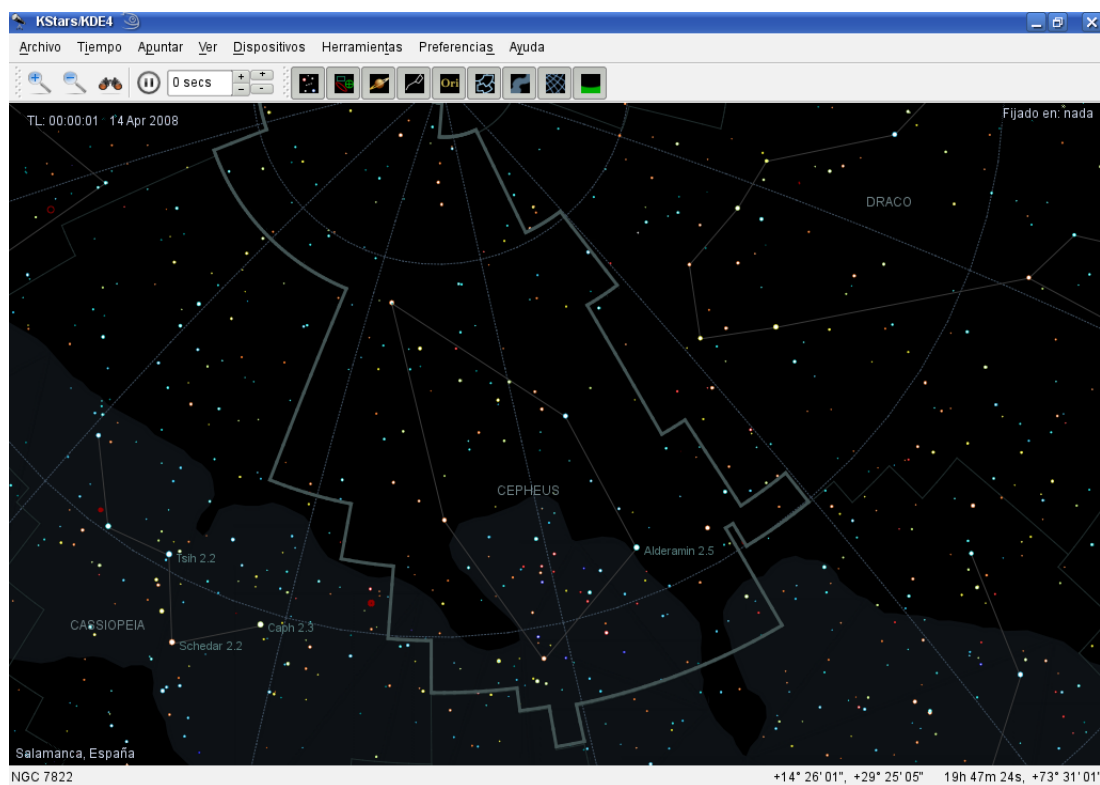


Figura 11.2: KStars

## 11.3. Stellarium

**Stellarium** es un planetario que muestra un cielo tridimensional, tal y como se vería a simple vista, con prismáticos o con un telescopio.

Posee un catálogo por defecto de más de 600.000 estrellas y otros extra con más de 210 millones. Proporciona imágenes de las constelaciones de diez culturas diferentes y una Vía Láctea, atmósfera, amanecer y ocaso realistas.

Otras de sus capacidades que le hacen destacar son su capacidad para controlar telescopios y la simulación de eclipses.

Es una aplicación multiplataforma disponible para GNU/Linux, Microsoft Windows y Mac OS.



Figura 11.3: Stellarium



## Capítulo 12

# Fractales e imágenes caóticas

### 12.1. GNU XaoS

**GNU XaoS** es un visor interactivo de fractales que permite al usuario hacer ampliaciones y reducciones de manera fluida y continua.

Puede generar una gran variedad de fractales de distintos tipos como Mandelbrot, Barnsley, Newton... También es capaz de guardar imágenes y vídeos de los fractales realizados.

Es una aplicación multiplataforma disponible para GNU/Linux, Microsoft Windows y Mac OS entre otros.

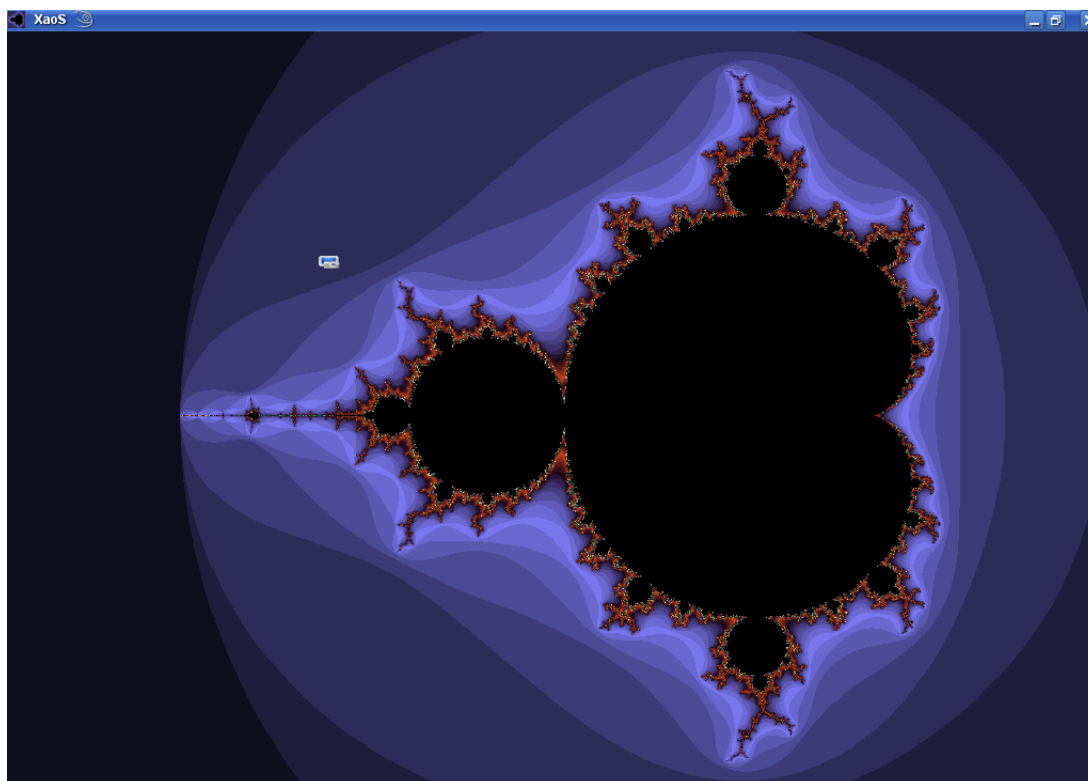


Figura 12.1: GNU XaoS

## 12.2. Fyre

**Fyre** es una herramienta para producir imágenes basadas en histogramas de funciones caóticas iteradas. Es una aplicación multiplataforma disponible para GNU/Linux y Microsoft Windows.

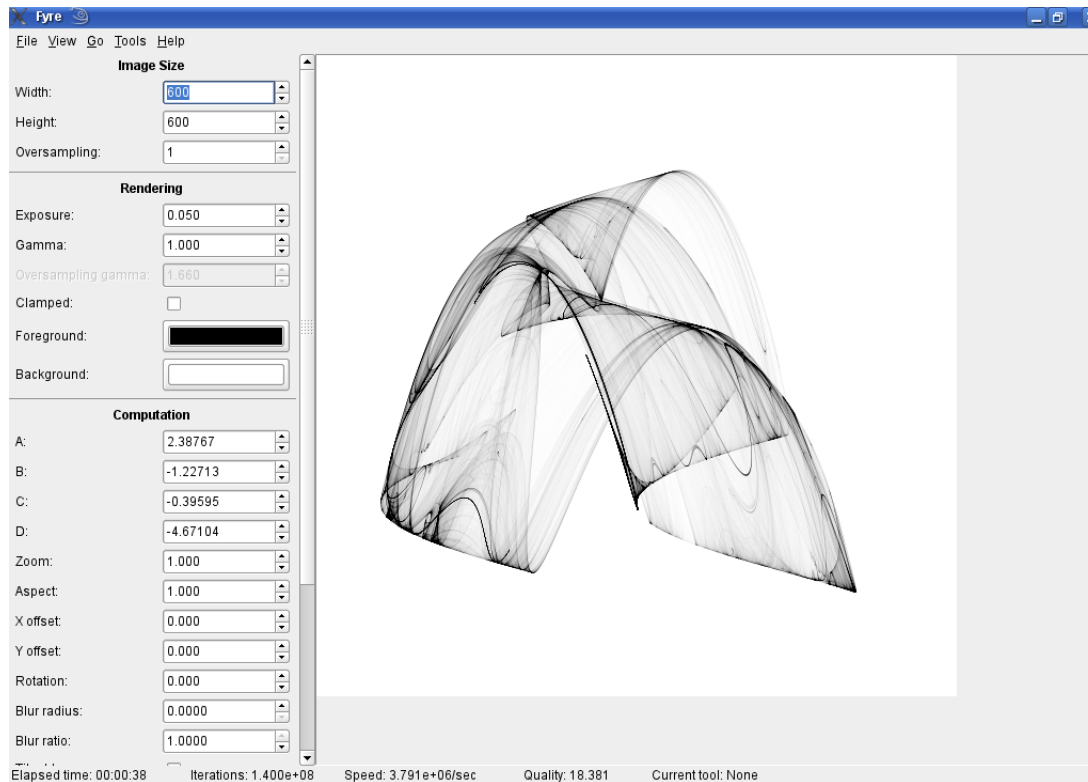


Figura 12.2: Fyre

## Apéndice A

# Paquetes de software científico en openSUSE 10.3

---

1

- Repositorio principal (OSS)
  - Packman Repository
  - openSUSE BuildService - KDE:Community
  - Desktop applications for education users
  - Software for scientists and engineers
  - Applications related to the earth (GIS, mapping, geodesy, GPS)
  - dmacvicar
-

<b>Programa</b>	<b>Paquete</b>	<b>Repositorio <sup>1</sup></b>
TeX	texlive	Repositorio principal (OSS)
LaTeX	texlive-latex	Repositorio principal (OSS)
Texmaker	texmaker	openSUSE BuildService - KDE:Community
Kile	kile	Repositorio principal (OSS)
GNU TeXmacs	TeXmacs	Repositorio principal (OSS)
LyX	lyx	Repositorio principal (OSS)
OpenOffice.org Math	OpenOffice_org-math	Repositorio principal (OSS)
gnuplot	gnuplot	Repositorio principal (OSS)
Qgfe		
Dia	dia	Repositorio principal (OSS)
Xfig	xfig	Repositorio principal (OSS)
GeoGebra	geogebra	Desktop applications for education users
GEONExT	geonext	Desktop applications for education users
GDIS		
Chemtool	chemtool	Repositorio principal (OSS)
Garlic	garlic	Repositorio principal (OSS)
Maxima	maxima	Software for scientists and engineers
wxMaxima	wxMaxima	Software for scientists and engineers
Xmaxima	maxima-xmaxima	Software for scientists and engineers
Yacas	yacas	Repositorio principal (OSS)
Axiom		
GNU Octave	octave	Repositorio principal (OSS)
QtOctave		
FreeMat	FreeMat	dmacvicar
R	R-base	Software for scientists and engineers
QCad	qcad	Repositorio principal (OSS)
PythonCAD	pythoncad	Repositorio principal (OSS)
GRASS	grass	Applications related to the earth (GIS, mapping, geodesy, GPS)
Logisim		
KiCad	kicad	Software for scientists and engineers
Kalzium	kde4-kalzium	Repositorio principal (OSS)
Celestia	celestia	Repositorio principal (OSS)
KStars	kde4-kstars	Repositorio principal (OSS)
Stellarium	stellarium	Desktop applications for education users
GNU XaoS	xaos	Repositorio principal (OSS)
Fyre	fyre	Repositorio principal (OSS)

Cuadro A.1: Paquetes de software científico en openSUSE 10.3

## Apéndice B

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