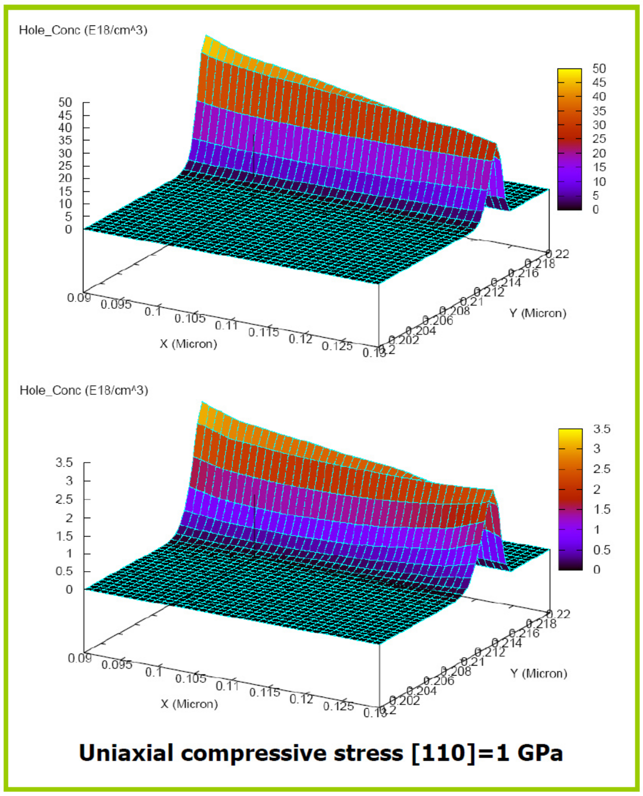
APSYS

Advanced Physical Models of Semiconductor Devices

What is APSYS

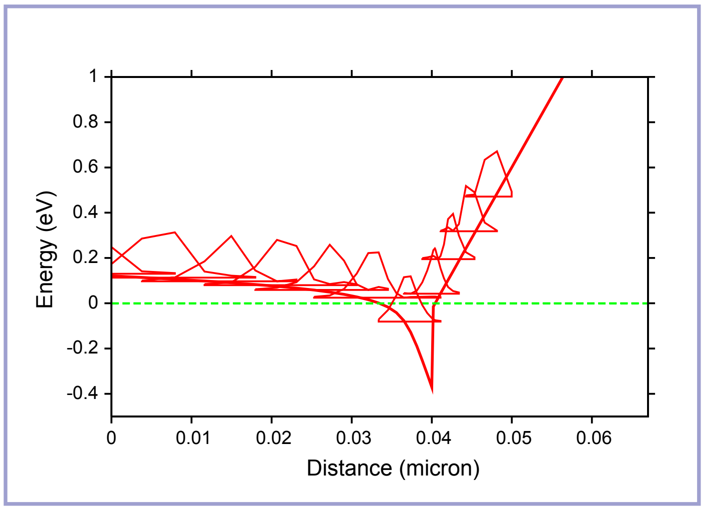
APSYS is a general purpose two-dimensional (2D) finite element analysis and modeling software program for compound semiconductor devices (with silicon as a special case). It includes many advanced physical models and offers a very flexible modeling and simulation environment for compound semiconductor devices. Advanced features include hot carrier transport, heterojunction and quantum well models. Optionally, 3D finite element analysis can be used (APSYS-3D option).

The simulation software is designed in such a way that user participation in developing his/her own physical models is encouraged. For example, the composition and temperature dependence of all of the physical parameters (bandgap, mobility, etc.) are located in a user accessible macro library with formulas written in the syntax of C/FORTRAN. These formulas are parsed and incorporated into the simulation software only at run-time (at a small cost to simulation speed) so that the user can modify and fine tune these formulas any time. Such an approach to physical parameters meets the need of computer aided design (CAD) for a new generation of semiconductor devices when the search for new material and new structures never seem to stop.



Ux-S-Si p-MOSFET [110] based simulation. 2D profile of quantized hole states under the gate.

Another unique feature of APSYS is its numerical stability against mesh points regardless the structure of the device. For a minimal amount of mesh points used, the simulator runs smoothly for a device with structural variation from a few nanometers in one direction (such as quantum wells) to hundreds of micrometers in another direction and it is still able to produce reasonable results. When the simulator can afford to use fewer mesh points, the speed increases. Such stability is extremely important especially in an initial stage of a simulation project when device engineers need to go through many trial-and-error cycles. We are pleased that many years of innovation in linear and non-linear numerical techniques results in praises from users of APSYS.



Electron wave functions in the 2D gas system of a GaN-based high electron mobility transistor (HEMT).

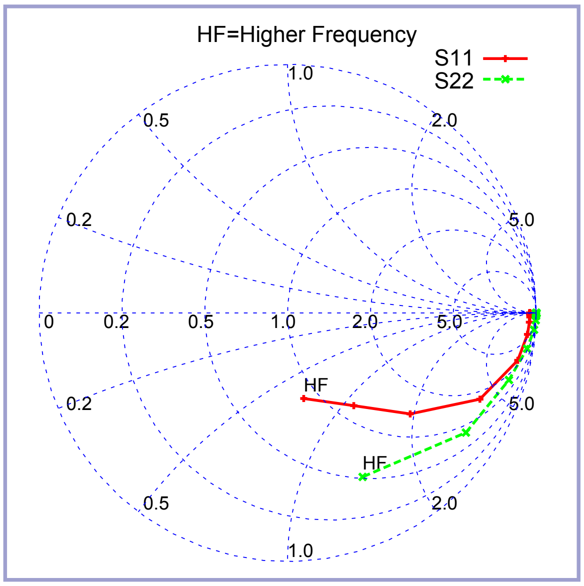
APPLICATIONS

- ☑ MOSFET
- ☑ JFET
- ☑ Photodetectors
- ☑ Solar cells
- ☑ HBT
- ☑ HEMT
- ☑ LED
- ☑ OLED
- ☑ RTD
- ☑ SOA

and more...

Physical Models and Advanced Features

APSYS is a full 2D/3D simulator which solves, self-consistently, the Poisson's equation, the current continuity equations, the carrier energy transport equations (hydrodynamic model), quantum mechanical wave equation, and the scalar wave equation for photonic waveguiding devices (such as waveguide photo-detectors). APSYS includes the following physical models and advanced features:

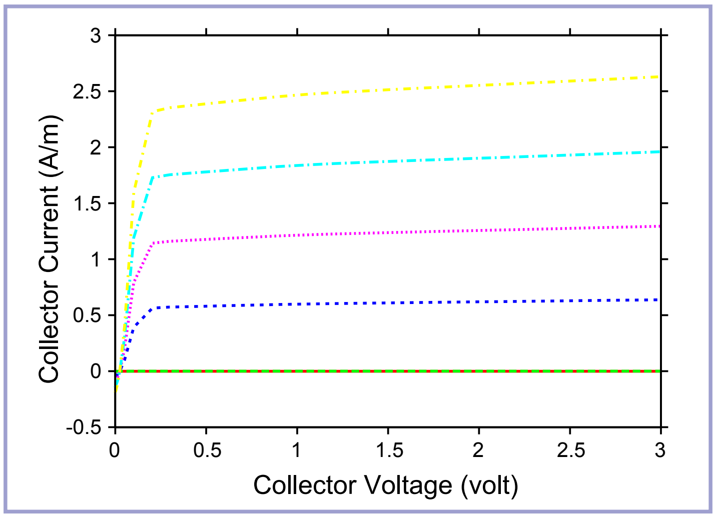


Simulated high frequency parameters S11 and S22 from AC analysis can be plotted on the Smith Chart or on linear plots.

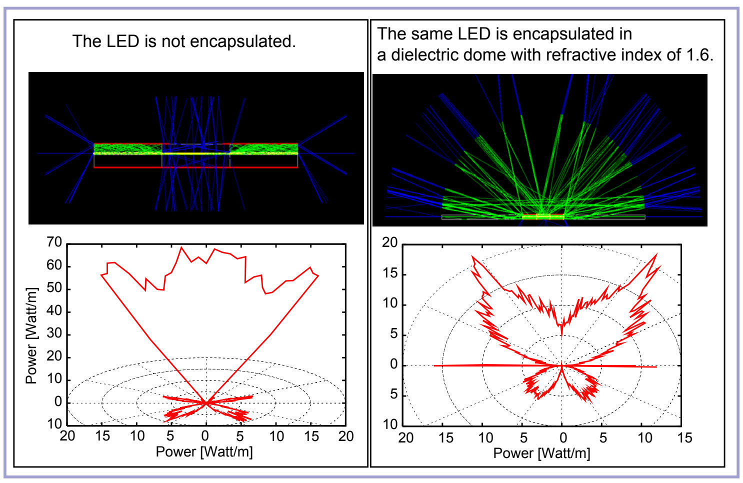
Physical Models & Advanced Features

- Hydrodynamic models for hot carriers
- Heat transfer equations
- Thermionic emission model
- Impact ionization model
- Deep level trap and trap dynamics
- Interface states
- Pool-Frenkel model
- Low temperature simulation model below 77K
- Guided optical modes(multimode)
- k.p theory for strained/unstrained QW/barrier
- Field dependent mobility model
- Large number of material models
- Temperature dependent model
- Flexible material parameter format
- Cylindrical coordinate system

and more...



Curves of the Ic-Vc characteristics of a bipolar junction transistor (BJT) can be conveniently produced by APSYS at different base current levels.



Use of ray-tracing technique to study the light extraction from an LED with and without an encapsulated dielectric dome.

Supported Platforms	**Windows 2000/XP**

Minimum System Requirements
1GHz Intel Pentium III processor
256MB RAM
300MB available disk space

CROSSLIGHT Software Inc.

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