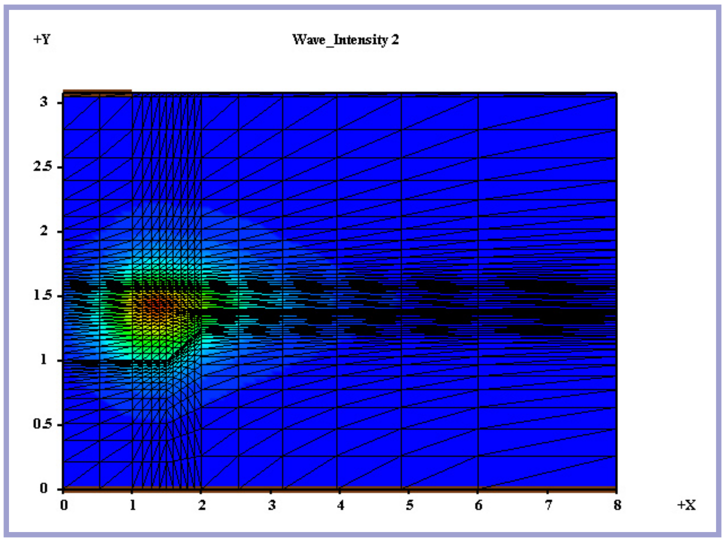
LASTIP Efficient 2D Laser Diode Simulator

What is LASTIP

LASTIP (LASer Technology Integrated Program) is a powerful device simulation program designed to simulate the operation of semiconductor lasers in two dimensions (2D). Given the structural and material properties, it produces a large amount of simulation data to describe the lasing characteristics. Based on well-established physical models, it provides the user with a quantitative insight into various aspects of a semiconductor laser.

It can be used as a computer aided design (CAD) tool to optimize existing lasers or to assess new designs. With the physical models and advanced capabilities of LASTIP, the user can concentrate on device optimization and design while leaving all the numerical modeling work to the computers.

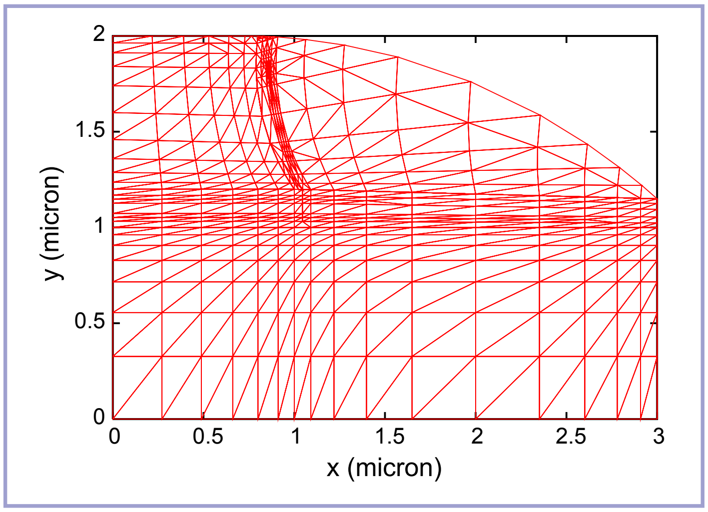


Second order mode intensity distribution simulated by LASTIP

CAPABILITIES

- ☑ Multiple cavity lasers
- ☑ Laser arrays
- ☑ Bipolar cascade lasers
- ☑ Multimode
- ☑ MQW structure
- ☑ Optically pumped lasers
- ☑ PML/EEIM method
- ☑ Short wavelength lasers
- ☑ Self heating effect
- ☑ Transient simulation
- ☑ Quantum tunneling effect
- ☑ Type-II MQW structures
- ☑ Many-body effect

and more...



Unstructured mesh generated to fit the material boundaries with curvatures.

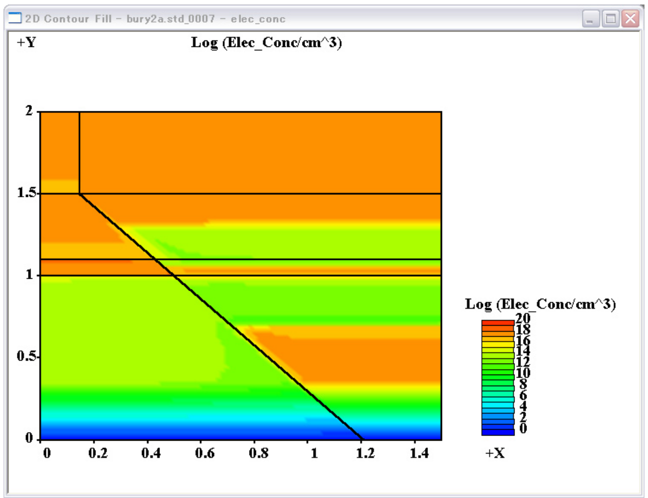
Physical Models and Advanced Features

In an arbitrary two-dimensional (2D) cross section of a semiconductor laser, LASTIP solves the following basic equations under continuous wave (CW) or transient conditions.

- Poisson's equation.
- The time-dependent electron and hole current continuity equations (drift-diffusion equation).
- The complex wave equation yields the optical field distribution in the transverse and lateral directions.
- The time-dependent photon rate equation.
- The Finite element method (FEM) is used to discretize the basic differential equations.

In addition, AC small signal model can be used on CW solutions to extract high frequency characteristics such as modulation response and AC capacitance.

Another unique feature of LASTIP 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 LASTIP.



Distribution of electron concentration in a buried-heterostructure laser

Physical Models & Advanced Features

- k.p theory for strained QW
- Valence mixing effects
- Sophisticated gain broadning function
- Carrier-carrier and carrier-phonon scattering
- Recombination model(SRH, Auger and etc.)
- Deep level trap and trap dynamics
- Pool-Frenkel model
- Interface states
- Fermi statistics for carrier concentration
- Incomplete ionization model
- Field dependent mobility model
- Non-linear gain suppression model
- Temperature dependent model
- Low temperature simulation model below 77K
- Large number of material models
- Flexible material parameter format
- Fully coupled Newton method

LASTIP is capable of generating large amount of output data including, but not limited to, the following.

Output data

2D structural data

Potential | Carrier distribution | Electric field
Current distribution | NFP | Band diagram
Temerature distribution

and more...

Bias dependent data

L-I | I-V | Current vs. Gain
Current vs. Index change

and more...

Spectral data

Modal gain | Spontaneous emission
Refractive index change

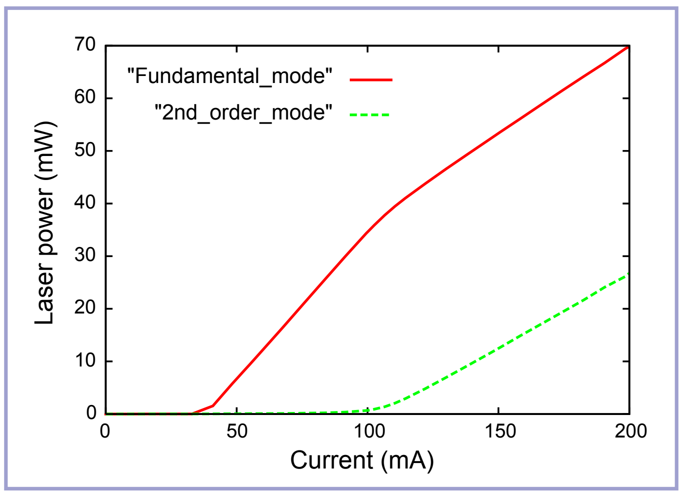
and more...

Far-field pattern

Time-dependent solution

High frequency characteristics from AC small signal analysis

All of above at different temperatures



Simulated light-current characteristics for a quaternary InGaAsP laser indicating lateral mode competition effect.

Supported Platforms	Windows 2000/XP

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

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