Photonic Crystal Surface Emitting Laser (PCSEL)
Photonic Crystal Surface Emitting Laser (PCSEL)

Photonic Crystal (PC)
- Periodic structure that guide OR stop the wave in certain direction.
- It can be a 1D, 2D, and 3D structure
  - Note, the DBR mirrors used in VCSEL can be considered as a 1D PC.

Photonic Crystal Surface Emitting Laser (PCSEL)

- Photonic Crystal (PC)
- 2D PC
  - PC structure with 2D periodic and homogenous in the third direction
  - Two main general variants
    - Dielectric rods in air
    - Air holes in dielectric region

Photonic Crystal Surface Emitting Laser
PCSEL

- Photonic Crystal (PC)
- 2D PC
- PCSEL

- A 2D PC is drilled inside the top DBR layer to focus the optical mode inside the cavity
Photonic Crystal Surface Emitting Laser

PCSEL

Structure

- Only quarter of structure was analyzed
- Using the symmetrical / asymmetrical Boundary conditions to calculate optical modes
Photonic Crystal Surface Emitting Laser

PCSEL

- Structure
  - Only quarter of structure was analyzed
  - Using the symmetrical / asymmetrical Boundary conditions
  - @ X=LenX/2
Photonic Crystal Surface Emitting Laser
PCSEL

- Structure
  - Only quarter of structure was analyzed
  - Using the symmetrical / asymmetrical Boundary conditions
    - @ X=LenX/2
    - @ Y=LenY/2
Photonic Crystal Surface Emitting Laser
PCSEL

Structure

- Only quarter of structure was analyzed
- Using the symmetrical / asymmetrical Boundary conditions
  - @ X=LenX/2
  - @ Y=LenY/2
  - @ Z=LenZ*0.25
Photonic Crystal Surface Emitting Laser

PCSEL

Structure

- Only quarter of structure was analyzed
- Using the symmetrical / asymmetrical Boundary conditions
  - @ X=LenX/2
  - @ Y=LenY/2
  - @ Z=LenZ*0.25
  - @ Z=LenZ*0.75
Photonic Crystal Surface Emitting Laser

PCSEL

- Structure
- Optical Modes
  - Mode #01
    - $\lambda = 0.84201793\,\text{um}$
Photonic Crystal Surface Emitting Laser
PCSEL

- Structure
- Optical Modes
  - Mode #02
    - $\lambda = 0.8420158 \text{ um}$
Photonic Crystal Surface Emitting Laser
PCSEL

- Structure
- Optical Modes
  - Mode #03
    - $\lambda = 0.8417980\,\text{um}$
Photonic Crystal Surface Emitting Laser
PCSEL

- Structure
- Optical Modes
  - Mode #04
    - $\lambda = 0.8417043$ um
Photonic Crystal Surface Emitting Laser

PCSEL

- Structure
- Optical Modes
  - Mode #05
    - $\lambda = 0.8416719$ um
Photonic Crystal Surface Emitting Laser
PCSEL

- Structure
- Optical Modes
  - Mode #06
    - $\lambda = 0.8415835 \text{ um}$
Photonic Crystal Surface Emitting Laser
PCSEL

- Structure
- Optical Modes
  - Mode #07
    - $\lambda = 0.8415491$ um
Photonic Crystal Surface Emitting Laser
PCSEL

- Structure
- Optical Modes
  - Mode #08
    - $\lambda = 0.8414225 \text{ um}$
Photonic Crystal Surface Emitting Laser
PCSEL

- Structure
- Optical Modes
  - Mode #09
    - $\lambda = 0.8413913$ um
Photonic Crystal Surface Emitting Laser

PCSEL

- Structure
- Optical Modes
  - Mode #10
    - $\lambda = 0.8413890 \text{ um}$
Photonic Crystal Surface Emitting Laser
PCSEL

- Structure
- Optical Modes
  - Mode #11
    - $\lambda = 0.8412996 \, \text{um}$
Photonic Crystal Surface Emitting Laser

PCSEL

- Structure
- Optical Modes
  - Mode #12
    - $\lambda = 0.8412917$ um
Photonic Crystal Surface Emitting Laser
PCSEL

- Structure
- Optical Modes
  - Mode #13
    - $\lambda = 0.8412740$ um
Photonic Crystal Surface Emitting Laser
PCSEL

- Structure
- Optical Modes
  - Mode #14
    - $\lambda = 0.8412678\,\text{um}$
Photonic Crystal Surface Emitting Laser (PCSEL)

- **Structure**
- **Optical Modes**
  - Mode #15
    - $\lambda = 0.8412109$ um
Photonic Crystal Surface Emitting Laser
PCSEL

- Structure
- Optical Modes
- LIV Curve
  • VI Curve
Photonic Crystal Surface Emitting Laser (PCSEL)

- **Structure**
- **Optical Modes**
- **LIV Curve**
  - VI Curve
  - LI Curve
  - Modal LI
Photonic Crystal Surface Emitting Laser
PCSEL

- Structure
- Optical Modes
- LIV Curve
  - VI Curve
  - LI Curve
    - Modal LI
    - All Modes LI