laoss
large area organic semiconductor simulation

version 4

Software for Design and Optimization of OLEDs, Solar Cells and Large-Area Panels

- FEM solver for electrical & thermal model
- Electrothermal coupling for Joule heat generation
- Optical model with 3D ray-tracing
Overview

- Easy-to-use. Get started quickly with FEM simulations without expertise.
- Intuitive Graphical User Interface (GUI) and workflow.
- High-speed computation on standard PCs.
- Wide range of different output data and comprehensive result visualization.

**Electrical Module:** Simulate the characteristics of large-area OLEDs and solar cells (current-voltage curves, total power dissipation, fill factor vs. conductivity, 2D-distribution of the electrical potential...)

**Thermal Module:** Model the two-way interaction between heat generation and current flow (electrothermal coupling) in OLEDs and solar cells.

**Optical Module:** Simulate in- and out-coupling in OLEDs and solar cells functionalized by complex 3D optical elements or surface texturing.

**Laoss Workflow**

1. Select the geometry and generate the CAD file.
2. Import a CAD drawing or create a geometry in laoss. Then, generate the mesh.
3. Run the simulation and visualize the selected output.
4. Import the I-V characteristics of the reference device. Define the material parameters.
5. The characteristics of the large-area device can be compared to the local I-V curve.

**Electrical Module**

A 2D Finite Element Method (FEM) solves Ohm’s law in the electrodes. The latter are coupled through the 1D I-V characteristics of the reference small-area device.

- Optimization of the design of the electrodes in OLEDs and PVs. Reduction of electrical losses [1].
- Studying non-ideal effects (e.g. electrical shunts).
- Automatic optimization of the electrode geometry.
- Understanding electrical cross-talk in a RGB OLED pixel array [3].

Laoss Workflow:

- Map of the potential at the top electrode of a 10x10 cm² OLED without metal grid.
- Potential distribution in a OLED with metal grid. The inset shows agreement between simulation and experiment [2].
- Map of the potential in a test OLED pixel array. Leakage current through the common layer causes light emission from not-addressed OLEDs.

**Thermal Module**

Electro ↔ thermal coupling method to simulate the two-way interaction between heat generation and current flow in OLEDs and solar cells

- Calculating the temperature distribution in OLEDs and solar cells under standard operation.
- Explaining non-ideal I-V characteristics of OLEDs and solar cells due to electrothermal coupling.

![Potential distribution (1) and temperature profile (2) in an OLED with hexagonal grid electrode](image)

![Temperature distribution in a OLED with metal finger electrodes. Simulated I-V characteristics of an OLED showing negative differential resistance (s-shape)](image)

**Optical Module**

An easy-to-use ray-tracing package to simulate 3D optical elements. This module can easily be coupled to Setfos [4] to analyze OLEDs and PVs with complex light-coupling geometries

- Modeling stand-alone 3D optical elements and their contribution to OLEDs and solar cells.
- Simulating optical cross-talk in OLED displays.

![Optical output of a Fresnel Lens under white light illumination](image)

![Light leakage through the color filter (CF) of not-addressed units in a test wOLED/CF array](image)

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