

# Combined optimization of shape and electronic circuit

MFX Team, Inria Grand-Est, Loria

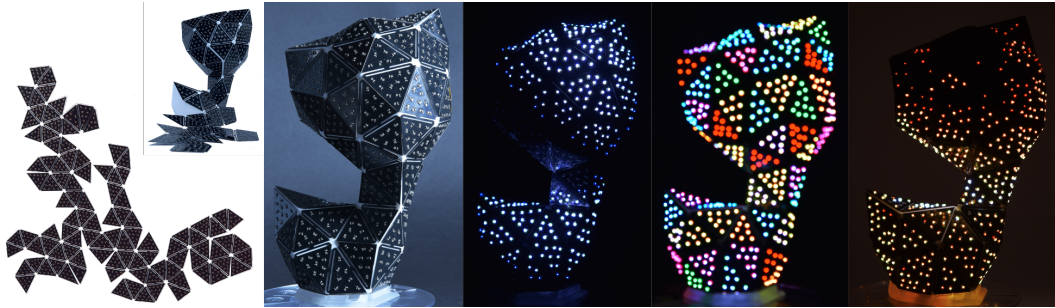


FIGURE 1 – One of our prototype (*kitten* 102 faces, 979 LEDs). *From left to right* : the flat PCB, the PCB folded onto the object, and the final results with the LEDs on.

## 1 Context and Goals

Printed circuit boards (PCBs) and electronic components are often integrated into the 3D shape around them. The change of design of one often impacts the other, making the design process complex and costly. The rigidity, flexibility and weight of the PCBs and components are not inconsequential and can even be a significant part of the structure of an object (drones, robots).

The MFX team recently started a project that aims to jointly optimize an object's shape and the electronic circuits integrated into it.

The conception of PCBs is by nature a geometric problem : organizing components and tracks on a domain with a layered geometry. This organization has to take into account geometrical technical constraints such as minimizing the length of certain tracks, ensuring that tracks from the same bus have the same length, controlling the width of a track or space between them. Despite significant advancements in Electronic Design Automation (EDA) softwares, creating PCBs or changing their design is still a complex and costly task.

Because of these difficulties, many possibilities of the PCBs are not fully exploited, such as the covering of curved surfaces. A first project resulting in a publication at SIGGRAPH 2023 consisted in the creation of foldable PCBs that align with the object in order to cover it with LEDs (Figure 1). We explore this direction of research jointly with the group of Bernd Bickel (IST Austria).

The goal of the postdoc is to continue this project further and overcome the current limits of the conception of PCBs.

## 2 Work environment and profil

We are looking to hire a postdoctoral fellow or an engineer for a year to further explore these ideas and overcome the current limits of the conception of PCBs. The position will be at the Loria in Nancy in the MFX team.

Candidate should have a Ph.D. in Computer Graphics, Electronic Engineering or Robotics or a relevant engineer degree.

Gross salary : 2833 euros per month, ajustable according to experience.

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