3D Modeling in Flexible PCB Design and Development

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Over the last decade while electronic products have become increasingly complex and dense as they support more functions, their physical forms have reduced dramatically as a result of evolving technologies.

The need for flexible circuits has responded exponentially, since they are received as the preferred solution to package weight reduction when compared to rigid planar boards. They are also easier to manufacture, reducing total assembly time while driving down cost and errors.

Flexible PCBs also provide greater system reliability, through their proven suitability for handling more than 25 point to point wires connections. Additionally, their main advantage is their ability to bend in order to accommodate the most cramped environments.

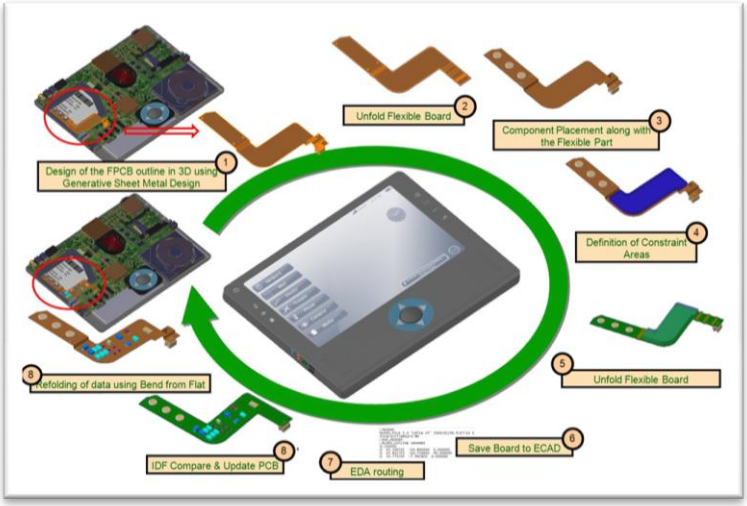

Fig 1 :End to end Process Coverage

These reasons make Flexible PCBs suitable for use in almost all electronics-based equipment, from hot consumer products such as digital cameras, computers and hard drives, to internal medical devices and military equipment. Thanks to flexible PCBs, we have seen generations of notebooks, tablet computers and myriad other devices reduce in weight over the last 5 or 6 years, while their features and functions have increased dramatically. Whatever the industry or the type of electronic product is the chance of encountering flexible PCBs is near 100%.

Cycle Time

Looking at how flexible PCBs are still sometimes designed today, and lengths of development cycle times, it is clear that there is considerable room for improvement. When Dassault Systèmes started to work on this subject with the leading Japanese worldwide consumer electronics company, we soon realized that their design process was slow, extremely complex and time consuming.

At this company the first steps of the development process were purely manual and involved placing the flexible PCB assembly within the product. Even today, some companies are still making paper PCBs by hand, and position checking manually throughout the product's physical mock up stages. Following this procedure, 2D drawings were generated and shared with the ECAD designer for component placement and routing. Within this outdated methodology mechanical and electronic design processes were conducted separately and exchanging design data between MCAD and ECAD systems at critical stages only became possible late in the development cycle. Limitations in data exchange and lack of co-design functionality resulted in the need for additional design iterations, driving up development time and cost.

3D - Flexibility

Designing a flexible PCB and making it fit into a complex mechanical in order to address design challenges and remove data exchange limitations.

Using CATIA 3D Flexible PCB Design, the end-to-end process is 100% digital. There are no work-flow breaks or manual operations.

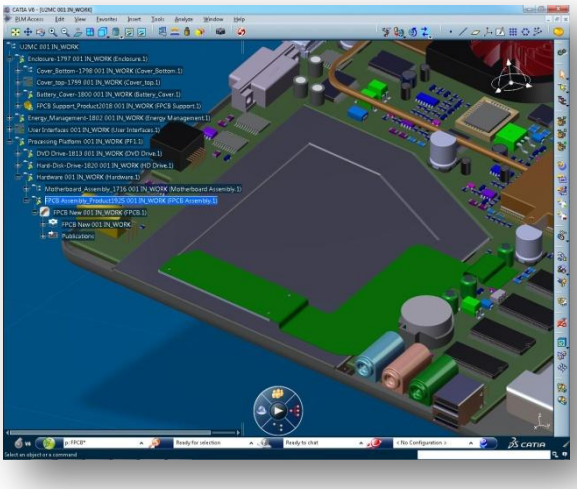

Fig 2. Flexible PCB in 3D Mock up

A typical use case scenario is:

1. Initially, the mechanical housing, including the shape of the flex board, is designed using CATIA. Hardware assemblies containing rigid and flexible boards, and mechanical components are developed.
2. The flexible PCB board outline is created by mechanical designers using CATIA, which also acts as unified a repository for evolving designs. This means that PCB board designs created in CATIA remain as digital models throughout their development cycle. **(Fig.2).**

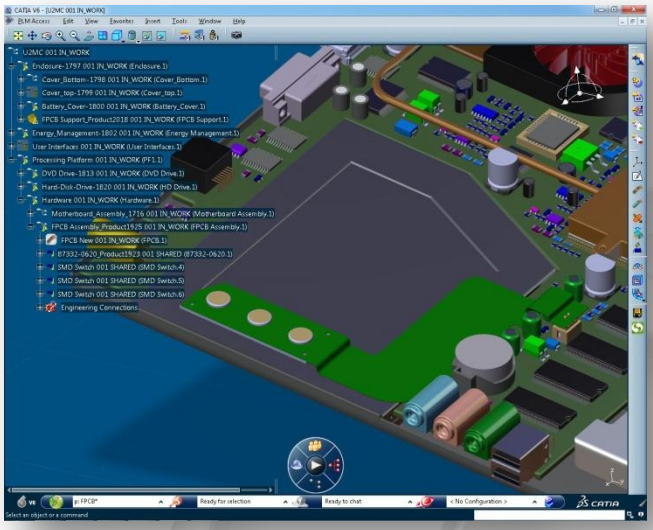

Fig 3. Positionning components

3. PCB board outlines can be flattened and folded back to their original 3D position.
4. Critical Components are placed in 3D and thereby benefit from a 3D virtual mock-up of the product. This allows them to be located on the board in the correct location, first time. **(Fig.3).**
5. In many cases stiffeners will be added to the 3D virtual board model.
6. Constraint Areas are added in 3D.
7. The flexible PCB board is flattened using CATIA. This flattened view of the Flexible PCB contains all 3D design information, along with the components and constraint areas. Data is exchanged with the Electronics Designers
8. Flexible PCB model is translated to ECAD via an IDF file.
9. All remaining electrical components are placed and coppers/wires are routed in ECAD. Electronic circuit design and electrical constraints are forward-annotated to the flex board shape and the board outline is created. Automatic placement of electronic components and routing is available.
10. After completion of the board layout, design rule checking is applied, and the board layout is forwarded to the MCAD system. Comparing this new design to the previous one and updating the MCAD session is key to increasing user efficiency. Components and copper traces are imported and added to the design and then folded back to their 3D position. Finally, the flexible PCB can be validated against the full 3D virtual mock-up.

Optimum Benefits

Dassault Systèmes customers that have implemented this design approach using CATIA Flexible PCB Design have experienced the following benefits:

- Primarily, Digital Design Process delivers drastic design time reductions. Customer testimonies claim time-savings up to 80%. Concurrent mechanical and electronic design of flexible PCBs facilitates optimum floor planning and routing on flexible boards, potentially reducing their size.

- Designing the flexible PCB in context with the 3D virtual Product Mock-up allows design iterations between MCAD and ECAD to be minimized. This makes possible right-first-time design, and reduces the need for physical prototypes.
- The 3D and flattened views of the flexible PCB will be used in downstream applications such as Drafting and Manufacturing. In case of design change, modifications are propagated seamlessly, leading to significant development cost reduction.

These benefits allow Flexible PCB Design users to obtain a quick ROI. As an example, a top worldwide leading cell phone manufacturer has experienced reducing from 5 days to less than one day the time to design a new flexible PCB. This is due to the complete, end-to-end, 100% digital integrated design process provided by Flexible PCB Design.

Process Coverage for Industry Leaders

From our customer references, a leading worldwide cell phone maker presents an interesting case where the technology is used today by several hundreds of hardware designers. The company has been using Flexible PCB Design for the past 3 years and were early adaptors of the technology. They implemented the product from its inception and have contributed to its current refinement.

Dassault Systèmes works closely with its users to improve their process coverage as well as their product functionality and reliability.

Another innovative user is a leading consumer electronics manufacturer. When the space left inside a device such as a car radio or a GPS system is considered it is easy understand why using an application like Flexible PCB Design provides them with the ammunition to create globally competitive products.

For Further Information: http://www.3ds.com/hightech