Interactive Design with Developable Surfaces

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Architects and designers share a long-standing interest in developable surfaces because of their aesthetic qualities and the advantages in fabrication they offer. This interest stems in part from the restrictions that the limitation to developable surfaces impose on the design. Digital design tools are required to handle these restrictions and allow the development of complex designs. While many CAD environments feature tools to create developable surfaces, existing tools are not adapted to the needs of designers, are inflexible and often even deliver erroneous or no results.

We address this problem by identifying categorically different design workflows and tasks and addressing each specifically in a unified design tool integrated into the commonly used CAD system Rhinoceros 3D. We co-developed interface metaphors and geometric representations best suitable for the specific tasks.

During an early stage of the design process, for example, a user might want to manipulate a surface freely in an intuitive way, willingly giving up some control over the shape, while later, during a phase of targeted design development, precise control over the shape in required. We demonstrate that this can be achieved by allowing the user to gradually add more constraints in the form of reference or guide geometry. Developing the design starting from a free-form surface by approximation is a very different problem, yet again.

We demonstrate novel solutions to these problems and their application in practice. Our efficient computational approach allows the optimization to run in the background and maintain a high degree of developability even while the user is interactively manipulating the surface – all integrated into Rhinoceros 3D.

Joint work with: Victor Ceballos Inza, Johannes Wallner, Helmut Pottmann.

References

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