Representations and applications of differential operators in geometry processing

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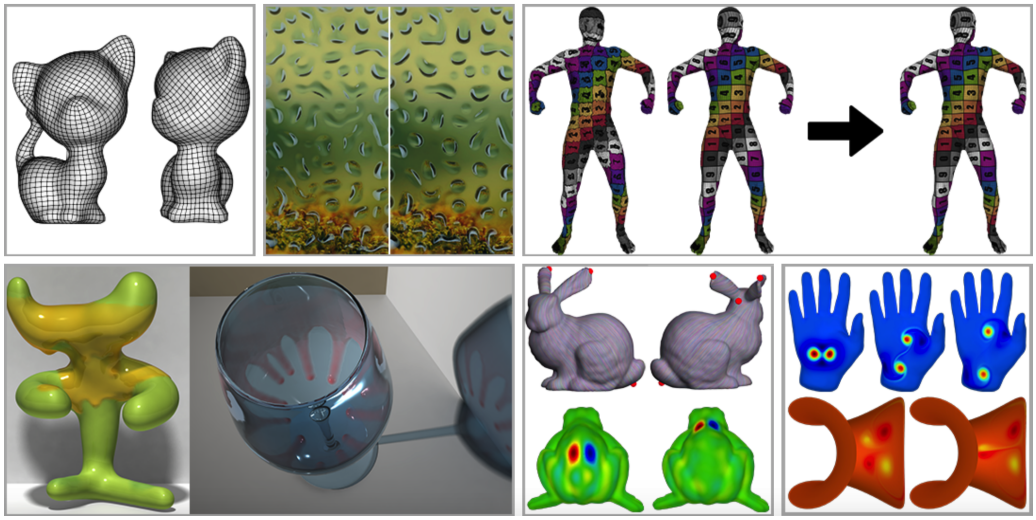

Geometry processing deals with the design of effective discrete methods for complex problems which appear in various areas of computational science and engineering. In practice, choosing a particular discretization machinery greatly affects the formulation of the problem and the analysis and design of its computational method. Consequently, methods may differ in practical aspects such as ease of implementation and preservation of geometric features due to the choice of discretization. In this talk, I will argue that in some cases rephrasing a geometrical problem in terms of linear mappings between vector spaces (operators) is beneficial when devising and implementing a discrete method. I will present some of the tools we developed and their application to problems such as vector field design and simulation of incompressible flows and thin films. In addition, I will discuss the inverse problem of computing correspondences between scalar functions and its effective solution using our operator machinery. This talk is based on the following papers [1], [6], [3], [5], [4], [2].

Joint work with: Mirela Ben-Chen, Maks Ovsjanikov, Martin Rumpf, Max Wardetzky, Orestis Vantzos, Frédéric Chazal, Etienne Corman and Steffen Weißmann.

References

[1] Omri Azencot, Mirela Ben-Chen, Frédéric Chazal, and Maks Ovsjanikov. An operator approach to tangent vector field processing. In *Computer Graphics Forum*, volume 32, pages 73–82. Wiley Online Library, 2013.

[2] Omri Azencot, Etienne Corman, Mirela Ben-Chen, and Maks Ovsjanikov. Consistent functional cross field design for mesh quadrangulation. *ACM Transactions on Graphics (TOG)*, 36(4):92, 2017.

[3] Omri Azencot, Maks Ovsjanikov, Frédéric Chazal, and Mirela Ben-Chen. Discrete derivatives of vector fields on surfaces–an operator approach. *ACM Transactions on Graphics (TOG)*, 34(3):29, 2015.

[4] Omri Azencot, Orestis Vantzos, and Mirela Ben-Chen. Advection-based function matching on surfaces. In *Computer Graphics Forum*, volume 35, pages 55–64. Wiley Online Library, 2016.

[5] Omri Azencot, Orestis Vantzos, Max Wardetzky, Martin Rumpf, and Mirela Ben-Chen. Functional thin films on surfaces. In *Proceedings of the 14th ACM SIGGRAPH/Eurographics Symposium on Computer Animation*, pages 137–146. ACM, 2015.

[6] Omri Azencot, Steffen Weißmann, Maks Ovsjanikov, Max Wardetzky, and Mirela Ben-Chen. Functional fluids on surfaces. In *Computer Graphics Forum*, volume 33, pages 237–246. Wiley Online Library, 2014.