



Real-time authoring of geometry-aware procedural textures

Proposal for a PhD in Computer Science at the University of Strasbourg, France.

Édition temps-réel de textures procédurales dépendant de la géométrie

Proposition de thèse de doctorat en informatique à l'Université de Strasbourg.

Procedural texturing for digital worlds. The huge size of virtual worlds in modern graphics applications is a challenge for the management (i.e. creation, editing, storage, transfer, processing and rendering) of the large amount of involved 3D data. Textures are a key ingredient when it comes to enrich the visual complexity of the scenes. Procedural texturing is an on-demand content generation method that drastically reduces pre-processing and storage requirements by synthesizing data based on a minimal set of parameters and, optionally, small exemplar textures as input. We aim at building upon recent advances in terms of quality [RS24] and robustness against parameterization issues [WRS25], and exploring parameterization-free algorithms (a.k.a. generation “on the surface”) [YKH10, PXM+24].

Creation and authoring of textures. The creative workflow relies on digital tools [Sub22] that integrate both artist-driven input and automated inference algorithms [BAD23, GGGS24]. The balance between these human and algorithmic contributions is context-dependent, varying with the application and desired level of control. In this project, we aim at exploring new tools for procedural generation of textures that combine automation and interactive artistic authoring directly on 3D surfaces, leveraging the underlying surface geometry. Furthermore, incorporating time-dependent dynamic effects can also be investigated.

PhD project. The PhD candidate will investigate new generation algorithms, and new control techniques for authoring. He/she will lay the mathematical foundations, design algorithms and implement them on graphics cards.

Hosting & supervision

The PhD candidate will be advised by Basile Sauvage and Pierre Kraemer. He/she will be hosted at the University of Strasbourg, in the Computer Graphics team of the ICube lab, whose research activities include texture synthesis and rendering, interaction, and geometry processing. Collaboration are considered with industrial partners to evaluate the authoring tools, and with University of Sherbrooke to develop and optimize GPU algorithms.

Links

- CG team at the ICube lab http://icube-igg.unistra.fr/en/index.php/Main_Page
- Basile Sauvage http://icube-igg.unistra.fr/fr/index.php/Basile_Sauvage
- Pierre Kraemer https://igg.icube.unistra.fr/index.php/Pierre_Kraemer

Who should apply

- Master degree in Computer Science, or equivalent.
- Strong background in computer graphics, mathematics, and programming.
- Additional skills in some of the following topics would be appreciated: rendering, texture synthesis, GPU programming, geometry processing.
- Fluent French or English speaking.

How to apply

Send a CV by early April to sauvage@unistra.fr and kraemer@unistra.fr

Related papers

[BAD23] G. Baldi, R. Allègre, J.-M.I Dischler. *Differentiable point process texture basis functions for inverse procedural modeling of cellular stochastic structures*. Computers & Graphics, Volume 112, Pages 116-131, 2023

[GGGS24] C. Grenier, E. Guérin , E. Galin , B. Sauvage. *Real-time terrain enhancement with controlled procedural patterns*. Computer Graphics Forum, 1, 2024

[FS24] R. Fournier, B. Sauvage. *Mix-Max: A Content-Aware Operator for Real-Time Texture Transitions*. Computer Graphics Forum, 43 (6), 2024

[PXM+24] E. Pajouheshgar, Y. Xu, A. Mordvintsev, E. Niklasson, T. Zhang, S. Süssstrunk. *Mesh neural cellular automata*. ACM Trans. Graph. 43, 4 (July 2024).

[Sub22] Substance 3D Designer, Adobe, 2022. <https://helpx.adobe.com/substance-3d-designer/home.html>

[YKH10] C. Yuksel, J. Keyser, D. H. House. *Mesh colors*. ACM Transactions on Graphics, 29 (2), 2010

[WRS25] Q. Wendling, J. Ravaglia, B. Sauvage. *Deformed tiling and blending: application to the correction of distortions implied by texture mapping*. Computer Graphics Forum, 44 (2), 2025