Surface colorization with the linear osmosis equation

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The osmosis model is a parabolic equation reconstructing a composite image from an input generally given by the drift fields extracted from one or several images [1]. This global model is sometimes a valid alternative to Poisson editing [2]. It is particularly adapted to tasks where the input images contrast vary wildly, as is the case for the application to image fusion. We prove that the osmosis global parabolic equation can be advantageously be replaced by a stationary local elliptic equation

$$\Delta u = \operatorname{div}(\mathbf{d}u). \tag{1}$$

We state its existence and uniqueness result and give it a consistent numerical scheme. We apply this model to 3D model texturation using satellite images, a challenging problem as the images are taken at different dates, with different illuminations and points of view, all of which can lead to severe contrast changes. An early result of our work is presented in Figure 1.

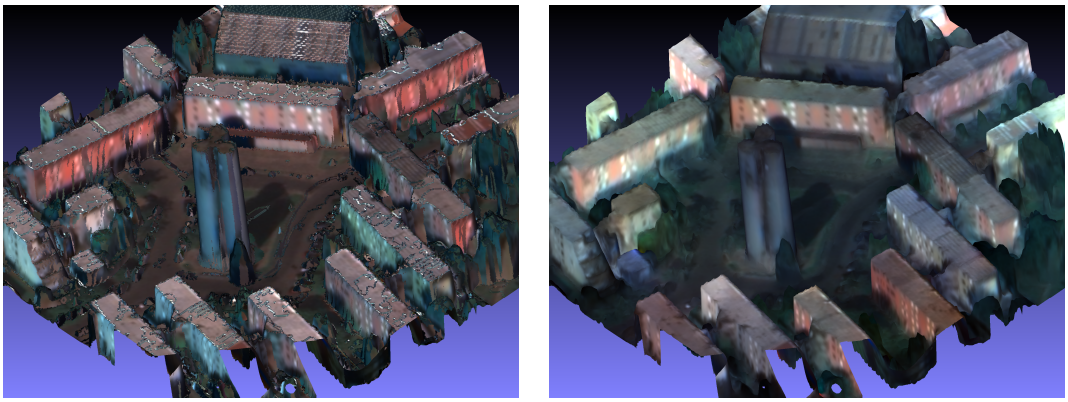

Figure 1: Left: 3D model textured with the most frontal image for each vertex. Right: result obtained by solving ont the mesh the elliptic osmosis equation obtained by taking for vertex the canonical drift vector field ($\mathbf{d} = \nabla I / I$) corresponding to the most frontal image.

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References

[1] Weickert, Joachim and Hagenburg, Kai and Breuß, Michael and Vogel, Oliver Linear osmosis models for visual computing. *EMMCVPR*, 2013.

[2] Pérez, Patrick and Gangnet, Michel and Blake, Andrew Poisson image editing *ACM Transactions on Graphics (TOG)*, 2003.