

## PhD position at IFP Energies nouvelles (IFPEN) Computer and information sciences

### Mathematical Morphology on Elevation maps: application to the characterization of catalyst supports and active phases

Elevation maps are images on which each point carries elevation information. These images are obtained by imaging methods involving a notion of 3D surface reconstruction, such as, for example, stereo reconstruction from at least two images observing the same scene with different viewing angles. These elevation maps can be obtained by scanning electron microscopy (SEM) for micrometer-scale objects, in particular using previous work by [Drouyer et al., 2017].

The targeted application is the advanced characterization of the active crystalline phases and supports of catalysts. The activity of these active phases is specifically linked to the particular orientations of certain crystalline faces and also to the areas of these faces.

We will be interested in developing operators to extract geometric characteristics such as particle size (object size histogram), surface area measurement, or surface classification as a function of the orientation of its normal.

To carry out this work, the proposed track is different from a standard approach consisting of reconstructing a triangulated 3D surface from the elevation map. This approach presents some limitations: depending on the triangulation method, inadequate consideration of strong discontinuities, and finally 3D calculations often complex. We propose to work directly on elevation maps using 2D image processing operations, particularly in the field of mathematical morphology. The interest of this original approach is that the algorithmic operations are relatively fast, and on the other hand that they use directly the initial data without transforming them.

[Drouyer et al., 2017] Drouyer S., Beucher S., Bilodeau M., Moreaud M., Sorbier L. (2017) Sparse Stereo Disparity Map Densification Using Hierarchical Image Segmentation. In: Angulo J., Velasco-Forero S., Meyer F. (eds) Mathematical Morphology and Its Applications to Signal and Image Processing. ISMM 2017. Lecture Notes in Computer Science, vol 10225. Springer, Cham

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<b>IFPEN supervisor</b>	PhD/HDR, MOREAUD Maxime, Contrôle, Signal, Systeme maxime.moreaud@ifpen.fr
<b>Doctoral School</b>	ED432 - Ecole Doctorale Sciences des Métier de l'Ingénieur <a href="http://edsmi.ensam.eu/">http://edsmi.ensam.eu/</a>
<b>PhD location</b>	IFPEN Solaize (69) FRANCE
<b>Duration and start date</b>	3 years, from (preferably): october 1, 2018
<b>Employer</b>	IFPEN, Rueil Malmaison, FRANCE
<b>Academic requirements</b>	University Master degree
<b>Language requirements</b>	Fluency in French or English, willingness to learn French
<b>Other requirements</b>	Image processing, applied mathematics, C/C++ programming

For more information or to submit an application, see [theses.ifpen.fr](http://theses.ifpen.fr) or contact the IFPEN supervisor.

#### About IFP Energies nouvelles

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