

**Research Topic for the ParisTech/CSC PhD Program**  
*(one page maximum)*

**Field:** *Information and Communication Sciences and Technologies*

**Subfield:** Geometry modelling, computer vision, virtual reality, augmented reality

**Title:** Shape modeling of the world through augmented reality

**ParisTech School:** Arts et Métiers

**Advisor(s) Name:** Prof. Fakhreddine ABABSA, Dr. Ruding LOU

**Advisor(s) Email:** [Fakhreddine.ABABSA@ensam.eu](mailto:Fakhreddine.ABABSA@ensam.eu), [ruding.lou@ensam.eu](mailto:ruding.lou@ensam.eu)

**(Lab, website):** <http://institutimage.ensam.eu/>

**Short description of possible research topics for a PhD:**

Nowadays the augmented reality (AR) technology becomes widely used in the daily life thanks to the newly innovated device such as Microsoft HoloLens. This technology usually allows people to interact with digital content in 3D (virtual mock-up) in the real world. In the literature, most of the research work have worked on how to visualize the virtual mock-up together with real elements, which let people believe it belongs to the real environment. The challenge was how to deduce the correct transformation (translation, rotation and scale) of the virtual mock-up according to the point of view on the real elements. Other works have illustrated various possibilities to interact with the virtual mock-up as what people can do with a real object. One application is to reshape or modify geometrically the virtual mock-up with the consideration of the real environment to which it should belong. **The contribution of this thesis is to propose a new AR system that allows people to redesign virtually the shape of the real objects.** The objects in the real world will be digitalized at first and then inserted into AR system to manipulate within in the real world. One major scientific challenge is how to handle the occlusion phenomena between the real and virtual objects?

**Required background of the student:**

Programming, geometric modeling, digitalization, mesh reconstruction and editing, computer vision and augmented reality.

**A list of 5(max.) representative publications of the group:** (Related to the research topic)

- H. Elchaoui Elghor, D. Roussel, **F. Ababsa**, E.H. Bouyakhf, “3D Plane-Based Maps Simplification For RGB-D SLAM Systems”. Journal of Theoretical & Applied Information Technology, Vol. 93 n 2, pp. 402 - 411, 2016.
- M. Maida, **F. Ababsa**, M. Mallem, M. Preda. “Hybrid tracking system for robust fiducials registration in augmented reality”. Journal of Signal, Image and Video Processing, Springer, Volume 9, Issue 4, pp 831–849, May 2015.
- **F. Ababsa**, M. Mallem. “Robust Camera Pose Tracking for Augmented Reality Using Particle Filtering Framework”. International Journal of Machine Vision and Applications (MVA). Springer-Verlag. Vol.22, No 1, pp. 181-195, 2011.
- **R. Lou**, J-P. Pernot, A. Mikchevitch, P. V éron, Merging enriched Finite Element triangle meshes for fast prototyping of alternate solutions in the context of industrial maintenance, Computer-Aided Design, Volume 42, Issue 8, Pages 670-681, 2010.
- B. Li, F. Segonds, C. Mateev, **R. Lou**, F. Merienne, Design in context of use: An experiment with a multi-view and multi-representation system for collaborative design, Computers in Industry, Volume 103, Pages 28-37, 2018.