

RESEARCH TOPIC FOR THE PARISTECH/CSC PHD PROGRAM

Field: *Design, Industrialization*

Subfield: Mech. Eng.

Title: Supervised learning for tolerance allocation

ParisTech School: Arts et Métiers Sciences et Technologies

Advisor(s) Name: Jean-Yves DANTAN, Lazhar HOMRI

Advisor(s) Email: jean-yves.dantan@ensam.eu

Research group/Lab: LCFC

Lab location: Arts et Metiers Campus of Metz

(Lab/Advisor website): www.lcfc.fr

Short description of possible research topics for a PhD:

Tolerancing decisions can profoundly impact the quality, the cost of the product and the number of scraps in mass production, Designers want tight tolerances to assure product performance; manufacturers prefer loose tolerances to reduce cost. There is a critical need for a quantitative design tool for specifying tolerances. The objective of this proposal is the tolerance allocation allowing designers to specify their functional requirements taking into consideration the impact of them on the manufacturing. Three tolerance synthesis techniques are commonly used: rules-based synthesis, knowledge-based synthesis and optimization synthesis. This proposal aims to push the frontiers of the tolerance synthesis by setting up a new methodology based on supervised learning (classification techniques) to infer the tolerance allocation model.

Required background of the student: Mech. Eng. or Ind. Eng.

A list of 5 (max.) representative publications of the group:

1. Goka, E., Beaufrepaire, P., Homri, L., Dantan, J.-Y., 2019, Probabilistic-based approach using Kernel Density Estimation for gap modeling in a statistical tolerance analysis, *Mechanism and Machine Theory*, 139, pp. 294-309.
2. Goka, E., Homri, L., Beaufrepaire, P., Dantan, J.-Y., 2019, Statistical tolerance analysis of over-constrained mechanical assemblies with form defects considering contact types, *Journal of Computing and Information Science in Engineering*, 19 (2), art. no. 021010-1.
3. Huang, Z., Dantan, J.-Y., Etienne, A., Rivette, M., Bonnet, N., 2018, Geometrical deviation identification and prediction method for additive manufacturing, *Rapid Prototyping Journal*, 24 (9), pp. 1524-1538.
4. Homri, L., Goka, E., Lévassieur, G., Dantan, J.-Y., 2017, Tolerance analysis — Form defects modeling and simulation by modal decomposition and optimization, *CAD Computer Aided Design*, 91, pp. 46-59.
5. Etienne, A., Mirdamadi, S., Mohammadi, M., Babaeizadeh Malmiry, R., Antoine, J.-F., Siadat, A., Dantan, J.-Y., Tavakkoli, R., Martin, P., 2017, Cost engineering for variation management during the product and process development, *International Journal on Interactive Design and Manufacturing*, 11 (2), pp. 289-300.