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## Process Optimization from Historical Data in Industry 4.0

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Design of experiments (DOE) [1], the key tool in the Six Sigma methodology, provides causal empirical models that allow process understanding and optimization. However, in the Industry 4.0 era, it may be difficult to carry them out, if not unfeasible, due to the generally high number of potential factors involved, and the complex aliasing [2]. Nevertheless, nowadays, large amounts of historical data, which usually present some unplanned excitations, are available in most production processes.

In this context, two approaches are proposed for process optimization. One is a retrospective fitting of a design of experiments (Reverse-DOE) to available data [3]. The second approach is by inverting Partial Least Squares (PLS) models [4]. Since latent variable models provide uniqueness and causality in the latent space, they are suitable for process optimization no matter where the data come from [4, 5].

The proposed approaches were applied to some datasets with different characteristics, highlighting the advantages and disadvantages of each one. Both are expected to be useful in the early stages when nothing is known about the process, driving subsequent real experimentation.

[1] G. E. P. Box, W. H. Hunter, and S. Hunter, *Statistics for experimenters*, Wiley, 2005.

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[4] C.M. Jaeckle, and J. F. MacGregor. *Chemom. Intell. Lab. Syst.*, 50(2):199–210, 2000.

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DOE, PLS, Historical Data

**Primary author:** GARCÍA CARRIÓN, Sergio (Universitat Politècnica de València (UPV))

**Co-authors:** BORRÀS-FERRÍS, Joan (Universitat Politècnica de València); FERRER, Alberto (Universitat Politècnica de València)

**Presenter:** GARCÍA CARRIÓN, Sergio (Universitat Politècnica de València (UPV))

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