



Postdoctoral Researcher in Operations Research, Optimization and AI for Sustainable High-Precision Manufacturing

Post-Doc position – 18 months

Main Workplace – LCFC, Arts et Metiers Institute of Technology (ENSAM) – 4 Rue Augustin Fresnel 57070 Metz

International partner – wbK Institute of Production Science, Karlsruhe Institute of Technology (KIT)

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Application deadline: October 16, 2026

Key Words:

High precision manufacturing, Operations research, Mathematical optimization, Machine learning, Circular manufacturing, Adaptive manufacturing, Uncertainty.

Description:

The position will be carried out within the LCFC laboratory (Laboratoire de Conception, Fabrication, Commande) of Arts et Metiers Institute of Technology (ENSAM). It is part of the ANR-funded H2-TACTICS project, conducted in collaboration with the wbK Institute of Production Science of the Karlsruhe Institute of Technology (KIT).

Regular scientific exchanges and research visits to wbK-KIT are expected.

The project addresses the development of sustainable and reliable manufacturing strategies for high-precision systems, such as hydrogen-valve assemblies. The researcher will work in an interdisciplinary domain with focus on:

- operations research, mathematical optimization and Machine learning;
- product and process modelling;
- measurement and quality engineering;
- adaptive and circular manufacturing;

Sustainable manufacturing has become a strategic focus as industries have begun exploring new ways to use resources efficiently and to reduce energy consumption. To address this aim, strategies as repair, reuse and remanufacturing are increasingly relevant. However, integrating used or remanufactured components can be challenging as used products are unreliable in terms of material and geometric properties compared to components coming from the traditional supply chain.

The H2-TACTICS project aims to develop decision-making and adaptive manufacturing methods that enable implementing circular strategies while maintaining product quality and system performance. The postdoctoral researcher will contribute to this objective by combining experimental data, optimization models and AI-based methods for functionality assessment and manufacturing adaption.

Research objectives:

Within this position, the main objectives are:

- *Model the product and its manufacturing system*
 - Comprehensive understanding of a hydrogen valve and its functional structure
 - Identification of the potentials and challenges for reuse or remanufacturing of individual components and their integration into the functional model.
 - Description of the relationships between components and process parameters, assembly decision, quality requirements and sustainability indicators
- *Develop and implement optimization and decision-making models*
 - Formulation of optimization models assessing product quality, cost, resource consumption and sustainability.
 - Investigation of appropriate operations-research methods
 - Develop decision-making models for dynamic tolerancing and adaptive manufacturing decisions.
- *Develop an adaptive manufacturing approach*
 - Definition of strategies for integrating reused or remanufactured components into assemblies and adaption of machine/ process parameters for new components.
 - Use measurement results and model predictions to support feedback-based manufacturing decisions

Profile and skills required:

- PhD. in Industrial or Mechanical engineering, operations research or applied mathematics.
- Solid background on mathematical modelling, machine learning and optimization, including the ability to select and apply appropriate data-driven methods to industrial problems.
- Strong programming skills (Python, Matlab, ...).
- Excellent written and spoken English.

References:

[1] V. M. Scharmer et al., 'Sustainable Manufacturing: A Review and Framework Derivation', Sustainability, vol. 16, no. 1, p. 119, 2023, doi: 10.3390/su16010119.

[2] D. Gauder, J. Götz, N. Jung, and G. Lanza, 'Development of an adaptive quality control loop in micro-production using machine learning, analytical gear simulation, and inline focus variation metrology for zero defect manufacturing', Computers in Industry, vol. 144, p. 103799, 2023.

[3] A. Khezri, V. Schiller, L. Homri, A. Etienne, J.-Y. Dantan, and G. Lanza, 'Development and analysis of a holistic function-driven adaptive assembly strategy applied to micro gears', Journal of Manufacturing Systems, vol. 69, pp. 48–63, 2023.

[4] G. Lanza, B. Haefner, and A. Kraemer, 'Optimization of selective assembly and adaptive manufacturing by means of cyber-physical system based matching', CIRP Annals, vol. 64, no. 1, pp. 399–402, 2015.

[5] L. Homri, M. R. Mirafzal, and J. Y. Dantan, 'A new tolerance allocation approach based on decision tree and Monte Carlo simulation', CIRP Annals, vol. 72, no. 1, pp. 105–108, 2023

[6] T. Tolio et al., 'Design, management and control of demanufacturing and remanufacturing systems', CIRP Annals, vol. 66, no. 2, pp. 585–609, 2017, doi: 10.1016/j.cirp.2017.05.001.

Application:

- Curriculum vitae, including research topics and the list of publications
- Cover letter describing your research experience and motivation for the position
- Contact details of two referees