The present work focuses on prediction of the particle flow and thus the design optimization of a triaxial nozzle for Laser Metal Deposition (LMD) technology adopted during additive manufacturing processes.

In particular, the study is focused on CFD (Computational Fluid Dynamics) simulations of the particle flow problem, regarding the coupling between a fluid phase, the carrier gas (Nitrogen), and a solid phase, a metallic material powder (316L Stainless Steel) that is delivered through the nozzle of the LMD 3D printer.

Two different methodological approaches are investigated: (i) the first based on an Eulerian method to describe the carrier gas flow combined with a Lagrangian method to describe the particle flow and (ii) the second approach based on a pure Eulerian method to describe both the carrier gas flow and the particle flow. Such approaches are both implemented in OpenFOAM, a open source C++ toolbox, and their efficiency and reliability are compared and tested with experimental data.

This work compares the two methods in terms of computational efficiency, implementation and physical applicability. Performance and accuracy of such methods are studied in order to reproduce minimum diameter of the powder cone, as measured in the experiments.