

## **COUPLING OF MATHEMATICAL SIMULATION AND METAL 3D PRINTING INTO AN USEFUL TOOL FOR TROUBLESHOOTING IN CHEMICAL TECHNOLOGY**

Skala M., Kolda J., Pátý M.

*NUM solution s.r.o, Prague, Czech Republic*

Mathematical simulation, namely computation fluid dynamics (CFD), has been present as a designers' tool for decades with its origins in elite field of aerospace industry. With the prices of computational power decreasing, CFD is finding its way to other industries. However, the idea remains the same; to provide faster, safer, cheaper or otherwise more sustainable alternative to a physical prototyping or experiment.

The problem which was preventing to benefit from the full potential of mathematical simulation was an exhausting and sometimes impossible process of translation the simulation results into the practice. With invention of 3D printing and its expansion into a broad range of printable materials, incl. stainless steel, small series or a single piece production of complex structures became widely available.

Mathematical simulation with its outputs as digital data and 3D printing with digital data as its feed are logically interconnected. Coupling of these two methods was successfully applied in caprolactam production plant (Spolana s.r.o.). The CFD simulation helped to visualize the system behaviour and to discover the root cause of the malfunction of dosing equipment. Subsequently the new part was manufactured with regard to the findings of the CFD study. The new 3D printed part was deployed and has been in application since September 2021 with all production requirements fulfilled. This example illustrates that CFD is no more only tool for designers but also technologists can take advantage of having this advanced method to support their activities.