HOL, CFD and AI as integrated methods of analysis

Enzo Bonacci
(The Natural Sciences Unit of ATINER, Athens, Greece)
E-mail: enzo.bonacci@physics.org

Since the mid-1990s, algebraic and geometric methods of analysis have been implemented in digital simulations with exponentially increasing efficacy in STEM applications. The outcomes are so accurate that many decisions about engineering questions like, e.g., selecting a three-blade marine impeller instead of a Rushton turbine as mixer in the batch crystallization of the citric acid monohydrate (CAM), could rely solely on Artificial Intelligence (AI) and Computer Fluid Dynamics (CFD). Nevertheless, as a pivotal experience by the Department of Chemical Engineering at the University "La Sapienza" of Rome (DICMA) plainly showed [1], Hands-On Laboratory (HOL) enriches the comprehension of a process [2] revealing crucial issues about safety and sustainability [3]. La Sapienza's traditional DICMALAB confirmed that the three-blade marine impeller gave an optimal crystal size distribution (CSD) thanks to the suspension state that the axial flow provides for the dispersed phase of CAM particles [4]. Vice versa, the Rushton turbined supplied bad CSD of CAM and posed serious hazards in terms of system stability, power consumption, and noise pollution. We infer that, whenever it is possible, HOL should integrate AI & CFD as method of analysis in the investigation of STEM problems.

References

[1] Enzo Bonacci. *Studio sperimentale sulla cristallizzazione dell'acido citrico*, volume 40 of *Diritto di Stampa*. Rome: Aracne Editrice, 2013.

[2] Enzo Bonacci. A Pioneering Experimental Study on the Batch Crystallization of the Citric Acid Monohydrate. *Journal of Chemistry and Chemical Engineering*, 8(6): 611–620, 2014.

[3] Enzo Bonacci. The Agitation Effects on the Batch Crystallization of the CAM. *International Journal of Mathematical Sciences and Applications*, 7(1): 65–71, 2017.

[4] Theodorus Nicolaas Zwietering. Suspending of Solid Particles in Liquid by Agitators. *Chemical Engineering Science*, 8(3–4): 244–253, 1958.