

How modeling and optimization can be applied in the field of PAT

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Especially within the pharmaceutical area, modern manufacturing relies on Process Analytical Technology (PAT) to build quality directly into the production process. Instead of focusing on hardware aspects and practical real-time monitoring applications, in this contribution the focus will be placed on modeling and mathematical optimization, and how specific frameworks might support practitioners in the area of PAT. The purpose of this talk is to provide a process systems engineering point of view to the PAT area and the involved systems. Finally, some insights will be shared on how such tools are applied within Takeda Pharmaceuticals and how they are tied to data-driven decision making. Ultimately, embedding these principles within manufacturing workflows can support the transition toward more resilient, efficient, and high-quality production environments.



Tim graduated from ETH Zurich with a MSc in Chemical and Bioengineering in 2018 and was subsequently employed by Lonza AG as a production chemist in antibody-drug-conjugate manufacturing. In 2020, he joined the group of Prof. Guillén-Gosálbez at ETH for his PhD in the field of Process Systems Engineering, focusing on modeling and optimization of chemical systems and bioprocesses. After his graduation in 2024, he joined Sulzer

Chemtech AG as an R&D Data Scientist where the responsibilities were in supporting the data-driven development of products and processes. In July 2026, he switched back to the pharmaceutical industry, where he started as a process modeling engineer at Takeda pharmaceuticals in Zurich.