# Holonic models for digital twins

## Supervisors

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## Context and thesis topic

Complex systems studies and simulations require to take into account complex systems characteristics. Simon has stated that numerous complex systems exhibit a more or less hierarchic structure [Simon, 96]. The idea is that the architecture of a complex system can be explained and understood using hierarchical organization structures.
Koestler has proposed the holon concept to merge holistic and reductionist points of view [Koestler, 67]. A holon is a self-similar entity that can be composed of holons as sub-structures. The underlying intuition is to use models of system with entities of different granularities. It is then possible to recursively model subcomponents of a complex system until the requested tasks are manageable by atomic easy-to-implement entities.
Meanwhile, Digital Twins (DT) are increasingly employed to visualize and manage complex systems. Often described as the digital counterparts of intricate physical systems, DT not only mirror their physical counterparts but also interact with them bidirectionally. By leveraging sensors, they capture the real-time state of physical systems, while actuators enable them to effect changes. Frequently integrated with external systems, DT are also used to predict the evolution of the underlying systems. In this way, DT function both as complex systems and as integral components of the larger ensemble that includes the physical asset. A holon-based methodology could thus provide a solid foundation for modeling, designing, and integrating digital twins.
This PhD aims to explore holonic modeling concepts to represent digital twins like in [Cossentino et al, 10]. The resulting models will be simulated according to the methodology defined in [Galland et al, 20].

## Bibliography

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