

Digital Twin support for Model-Based Human Systems Integration

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Abstract. This paper presents the digital twin (DT) concept to support model-based human systems integration (MB-HSI). A DT can be considered a model that enables the simulation and observation of various emerging socio-technical system (STS) activities. It can also be regarded as a vivid documentation system supporting design and operational processes. It is a software-based assistant system replacing traditional tools. From this perspective, a DT has become a mandatory tool for developing appropriate social-cognitive (multi-agent) models and methods that are helpful throughout the life cycle of contemporary sociotechnical systems. It enables accounting for the complexity and tangibility of human-centered context-sensitive architectures, combining procedural and declarative knowledge. Combining DT technology and HSI approaches requires a set of fundamental axioms, some theoretical abstractions, and valuable practical models, which are presented and illustrated in this paper. MB-HSI supported by DT technology is consequently defined as a process and a product at the confluence of several areas, such as systems engineering, human factors and ergonomics, information technology, and specific sectors, such as aerospace, health, and energy. More specifically, DT enables people and organizations to be considered early in the design and development processes and during the whole life cycle of an STS. This paper will provide a deeper foundation for DT technology based on an epistemological approach.