

Manufacturing Digital Twin (MDT), or the virtual counterpart of manufacturing processes, demands the integration of different communication protocols, sensing and computer simulations and other digital technologies commonly described as Industry 4.0 core technologies.

Data is at the heart of the matter for building MDT, and the critical challenge is the size of data to draw on. SKC Engineering is pioneering the developing of hybrid MDT that incorporate Artificial Intelligence (AI) strategies, Simulation Tools, and Sensor Reading to work with limited data – by far less than typical data mining methods. The hybrid MDT is consistently improving by active learning strategy that wisely tunes up already partially capable hybrid MDTs toward higher fidelity. Hybrid MDTs can on-the-flight interact with real-world data collections for continual re-tuning based on actual observations over the initial training data.

As proof of concept, SKC Engineering has established a hybrid MDT of welding fabrication for control of welding distortion within a reasonable timeline of a marine application. This MDT combines end-to-end deep learning models, Finite Elements (FE) simulations, and Laser scanning data to control the welding distortion.

Hybrid DTs can integrate Advanced Manufacturing ecosystems with potential broad, long-term commercial impacts. For example, real time control of shape, geometry and tolerance of additive manufactured parts. Life cycle management and projection of service conditions for manufactured parts based on real time history of manufacturing and detection of the weakest point of performance. The platform enriches the Canadian manufacturing sector by leading in the use of DT for interactive process design and maintenance that eventually reduces the cost of delivering quality products.

We are looking to extend the hybrid DT framework to:

- (i) Industrial partner(s) with complex manufacturing process with data sensing and ideally modellable by FE simulations. Preferably metallic component manufacturing, additive manufacturing and metal additive manufacturing.
- (ii) Computational infrastructure partner(s) for the implementation of DTs as a Service (DTaaS), i.e. cloud computing, data infrastructure, etc.
- (iii) Smart sensor and data collection partners, i.e. laser scanners, lidar scanners, ultrasonic, etc.

Applus Canada (SKC Engineering) is a premium provider of high-end services and consultancy to metal manufacturing and fabrication companies throughout Canada, the United States, and Asia. The company offers full spectrum services to over 250 clients regarding design, inspection, certification, lab testing, prototyping and industrial R&D. The company is well-known with strong track record of experience in using emerging technologies such as artificial intelligence and advanced simulation tools to develop solutions beyond the standard. The team consists of professionals in data science, computational analysis, and manufacturing engineering who applies up-to-the-minute knowledge and technologies to design, develop and enhance client products, services or facilities.