Dr. Marzieh Khakifirooz has a Ph.D. in Industrial Engineering and Engineering Management and an M.S. degree in Industrial Statistics from the National Tsing Hua University (NTHU), Hsinchu, Taiwan. Currently, she is an assistant professor at the school of engineering, Monterrey Institute of Technology, Mexico. Dr. Khakifirooz has outstanding practical experience from her various global consultancies for high-tech industries. Her research interests include the application of optimization in smart manufacturing, Industry 4.0, decision making, and machine teaching. She is an active member of System Dynamic Society, Institute of Electrical and Electronics Engineers (IEEE), and Institute of Industrial and Systems Engineers (IISE).

Keynote Title:

Copula Clustering for Identifying Low Accuracy Production Facility

In a modern manufacturing environment, the adoption of advanced computing, intelligent process control, and preventive maintenance impact on the nature of the quality control process. The traditional quality control process is not enough for defect detection and abnormalities identification. Besides, the high complexity of manufacturing processes brings new challenges for quality assurance and yield enhancement, such as multi-fab production, high-mixed scheduling process, and operator-free back-end process. In addition, controlling the production process in a highly dependent data, and the non-stationary environment is one of the technology's created challenges. To prevent errors and enhance the yield in a non-stationary production plant, the priority for yield and quality control engineers is to identify the low accuracy production facilities and replace them with good-performances tools.

This study aims to present a method for identifying the low yielded productions tools, considering the dependency among manufacturing variables. In proceeding the yield enhancement process, for each batch of products, a set of nominal information of manufacturing facilities over the horizon of the production process along with their corresponding yield value is collected. Encoding attributes of nominal variables to binary information is a reliable way to deal with the computational complexity of nominal data. However, high dimensionality and multicollinearity are unavoidable results of the nominal-data transformation. Researches are investigated on methods to reduce the dimension and dependency among data using techniques such as principal component or factor analysis. However, spars nature of binary data makes these approaches inefficient. Therefore, models that can benefit from the joint distribution of binary data can perform

better with dependency, multicollinearity, and sparsity. In this study, utilizing the copula function, we can find clusters of low, high, and medium yielded production facilities, regards the complex structure of the high-dimensional and sparse binary data. The results compare with other model-based clustering approaches and have advantages in computation time and accuracy.