In my dissertation, we concentrate on a special type of case-level order fulfillment technology - an "automated storage and retrieval system with multiple in-the-aisle pick positions" or "MIAPP-AS/RS". These systems are very common in temperature-controlled warehouses, and as the global demand for frozen food and pharmaceutical items is expected to grow by high rates, the number of MIAPP-AS/RS implementations is increasing. MIAPP-AS/RS are an effective way to pick cases and is used to reduce the number of operators who are required to work in the harsh environments, as well as to reduce the amount of space that is required to be temperature controlled (which is both financially and environmentally expensive).

Our contributions in this area consist of three parts. Our first contribution includes the first study to analyze AS/RS with multiple in-the-aisle outputs. In our Second contribution, we considered MIAPP-AS/RS used to fulfill orders for non-identical items' demand, which relaxed some of the assumptions we made in the first contribution. Specifically, we focused on an important practical design decision, the optimal SKU assignment problem. We studied the impact of different pick position assignments on system throughput, as well as system design trade-offs that occur when the system is running under different operating policies and different demand profiles. We developed optimization models to find the optimal assignment that minimizes the expected travel time. Finally, we developed optimization models using Benders decomposition to model the SKU assignment problem for dedicated and class-based storage policy for MIAPP-AS/RS.

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The public is welcome to attend.