Time & Location: November 1, 2011 at 10:00 AM in ENGR1 288
Title: Design of the layout of a manufacturing facility with a closed loop conveyor with shortcuts using queueing theory and genetic algorithms

With the ongoing technology battles and price wars in today's competitive economy, every company is looking for an advantage over its peers. A particular choice of facility layout can have a significant impact on the ability of a company to maintain lower operational expenses under uncertain economic conditions. It is known that systems with less congestion have lower operational costs. Traditionally, manufacturing facility layout problem methods aim at minimizing the total distance traveled, the material handling cost, or the time in the system (based on distance traveled at a specific speed).

The proposed methodology solves the looped layout design problem for a looped layout manufacturing facility with a looped conveyor material handling system with shortcuts using a system performance metric, i.e. the work in process (WIP) on the conveyor and at the input stations to the conveyor, as a factor in the minimizing function for the facility layout optimization problem; which is solved heuristically using a permutation genetic algorithm. The proposed methodology also argues the case for determining the shortcut locations across the conveyor simultaneously (while designing the layout of the stations around the loop) versus the traditional method which determines the shortcuts sequentially (after the layout of the stations has been determined). The proposed methodology also presents an analytical estimate for the work in process at the input stations to the closed looped conveyor.

It is contended that the proposed methodology (using the WIP as a factor in the minimizing function for the facility layout while simultaneously solving for the shortcuts) will yield a facility layout which is less congested than a facility layout generated by the traditional methods (using the total distance traveled as a factor of the minimizing function for the facility layout while sequentially solving for the shortcuts). The proposed methodology is tested on a virtual 300mm Semiconductor Wafer Fabrication Facility with a looped conveyor material handling system with shortcuts. The results show that the facility layouts generated by the proposed methodology have significantly less congestion than facility layouts generated by traditional methods. The validation of the developed analytical estimate of the work in process at the input stations reveals that the proposed methodology works extremely well for systems with Markovian Arrival Processes.

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Approved for distribution by Dr. Dima Nazzaal, Committee Chair, on October 10, 2011.

The public is welcome to attend.