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Material Supply Mechanisms for Contemporary Assembly Systems

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Abstract : Manufacturing of complex products such as automobiles and computers requires a very large number of parts and sub-assemblies. The design of mechanisms for delivery of these materials to the point of assembly is an important manufacturing system and supply chain challenge. Different approaches to this problem have been evolved for assembly lines designed to make large volumes of standardized products. However, contemporary assembly systems are required to concurrently produce a variety of products using approaches such as mixed model production, and at times even mass customization. In this paper we examine the material supply approaches for variety production in moderate to large volumes. The conventional approach for material delivery to high volume assembly lines is to supply and stock materials line-side. However for certain materials, especially when the same or similar items are used along the line, it is more convenient to supply materials in kits. Kitting becomes more preferable when lines concurrently produce multiple products in mixed model mode, since space requirements could increase as product/ part variety increases. At times such kits may travel along with the product, while in some situations it may be better to have delivery and station-specific kits rather than product-based kits. Further, in some mass customization situations it may even be better to have a single delivery and assembly station, to which an entire kit is delivered for fitment, rather than a normal assembly line. Finally, in low-moderate volume assembly such as in engineered machinery, it may be logistically more economical to gather materials in an order-specific kit prior to launching final assembly. We have studied material supply mechanisms to support assembly systems as observed in case studies of firms with different combinations of volume and variety/ customization. It is found that the appropriate approach tends to be a hybrid between direct line supply and different kitting modes, with the best mix being a function of the manufacturing and supply chain environment, as well as space and handling considerations. In our continuing work we are studying these scenarios further, through the use of descriptive models and progressing towards prescriptive models to help achieve the optimal approach, capturing the trade-offs between inventory, material handling, space, and efficient line supply.

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