Adaptation systems, to the domain of industrial assembly.

Adaptationof Reconfigurable Manufacturing Systems for Industrial Assembly – Review ofFlexibility Paradigms, Concepts and Outlook Paper Review Mubashir JaleelDepartment of MechanicalEngineering, College of E&ME NUST Abstract— The research paperwritten by Guido Huettemann, Christian Gaffry and Robert H.

Schmitt (2016) hasbeen reviewed in this paper. The intuition for writing the review is based on amaster’s level class assignment and hence be regarded proportionate to theknowledge base of the author of this review. The paper proposes the feasibility of adaptationof Reconfigurable Manufacturing Systems (RMS), designed for machiningsystems, to the domain of industrial assembly. Literature review, interviewsand ongoing research on subject have been included / consulted for the proposedtheoretic analysis. Turbulent market under global competition hasintroduced continuously varying products with lesser lot sizes.

As the marketdemand and requirement of variety increases so does the pressure onmanufacturing systems’ designers to speedily find optimum production solutionswith least changeover and setup durations. This leads to the increasedrequirements of reconfigurations in manufacturing systems. Reconfiguration havebeen widely researched for machining processes, however present manufacturingsystems don’t have flexibility of Reconfigurable Assembly Systems (RAS)due to physical constraints of fixed transfer systems for including newprocesses. The authors find these limitations as a prompt for new approaches inmanufacturing system design to allow manufacturing system changes. The authors have elaborated the benefits of RMS proposed by Koren andShpitalni (2010). RMS is a combination of throughput of Dedicated ManufacturingLine (DML) and flexibility of Flexible Manufacturing Systems (FMS). Manufacturing system is reconfigurable when it is designed around a part familywith just enough customized flexibility. Suggested machine configurations withcross overs improve productivity, responsiveness and convertibility.

Moremachines can be added in cell configuration to increase scalability. Though theabove elaborated proposal mainly focuses on machining systems, however, theauthors find them generally applicable to assembly systems which is plausibledue to characteristics of RMS. Though research on RMS for assembly systems isundergoing yet its application for industrial assembly is not known. Reviewed literature is cited at www. sciencedirect.

com/science/article/pii/S2212827116307636 After elaborating the benefits and applicability ofRMS, the authors have made a comparison of machining and assembly systems forconcluding the similarities for cross application. Machining assembly systemsdiffer in that machining processes involve rough parts, tools and transformthem into finished parts, while assembly systems comprise variety of materialsinvolving finished parts auxiliary materials which are provided just in time (JIT)and just in sequence (JIS) for efficiency of assembly systems. Machiningsystems typically rely on tools and usually have inherent flexibility howeverassembly systems are limited by adjustability and exchangeability. Machiningand assembly processes also differ in organizational aspects, divisibility ofprocesses and duration of tasks. After drawing the difference in systemsof machining and assembly, the authors suggested a comparison network forflexibility paradigms based on two axes, one covering production level and theother object level that is being assessed. Production levels are based on productionnetwork, factory segment, line and work station while object level includesproduction resources, organizational aspects and control scheduling withinthose production levels. After the comparison, suitability of these paradigmsfor use in industrial assembly was sorted to derive necessary conclusions.

Theauthors concluded that though RMS fulfil necessary conditions of flexibility paradigm however remains unableto incorporate material flow for parts that are to be assembled to the mainproduct due to limitations of present RMS design for single part material flow. Since current RMS does not support complex material flow so the authorssuggested further Research and Development (R) for incorporation of RMSmachining concept in industrial assembly. These include Transfer Systemsfor efficient omnidirectional routing, Logistics with ability to deliverrequired parts in time and materials without causing delays, Scheduling ofassembly tasks and their associated logistic operations and Interoperabilityfocusing on skill based integration so that new work stations can be added atany time. Though the authors referred engine and its major parts as case understudy however the data on their machining, assembly systems and their differencesis not discussed in specific. The authors concluded that the concept of RMSparadigm is viable for adaptation of complex multi-model assembly lines withsmall lot size.

Moreover, key areas have been identified for further researchfor application in industrial assembly.