

## ANALYSIS OF MODULE REUSE IN INVERSE MANUFACTURING

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**ABSTRACT.** *As environmental issues have become serious, the significance of product life cycle is recognized to establish a sustainable society, and Inverse manufacturing concept is discussed for product life cycle. To realize the inverse manufacturing system the prime problem is how to improve the rate of reusing the product modules. Therefore analyzing the life-time of the disassembled modules is very important before reassembling process. In this paper, first a cumulative damage model is proposed to discuss the failure of the product that is assembled by reuse modules. It is supposed that modules suffer damages due to shocks and fails when the cumulative damage level exceeds the failure level, and compute the probability of failure. Then maintenance cost will be analyzed in order to minimize the expected maintenance cost-rate. The optimal maintenance time  $T$  and optimal number of damages  $N$  will be also discussed in this cumulative damage model, and the probable safe life-time of module reuse will be explored by the  $T$  and  $N$ . Finally a numerical example is given for some exponential cases to confirm the validity of the proposed model.*

**Keywords:** Inverse manufacturing, Reuse, Lifecycle, Life-time, Module, Damage model

**1. Introduction.** Recently, as environmental problems have become aggravated, some methods have been discussed to change the situation in order to save the limited resources and energy. To attack these problems, a circulation type society is advocated to decrease the environmental burden. Therefore, inverse manufacturing concept is discussed to realize it, particularly in circulation production. Waste electrical and electronic equipment (WEEE) directive is promulgated (03.2003) in Europe, with the aims to reduce the waste arising from electrical and electronic equipment, to encourage reuse, recycling and recovery and to improve the environmental performance of all operators involved in the lifecycle. Eco-efficient has been evaluated by implementation of WEEE in recycling system and by achieving economy of scale in recycling system [1]. Although many authors have proposed various concepts about inverse manufacturing, for the operator there are a lot of problems that need to be solved to realize circulation production. In general, three essential directions in inverse manufacturing system as show in Figure 1: