Component Obsolescence Management Model for Long Life Cycle Embedded System

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Abstract—**This paper discusses the component obsolescence problem and presents a mathematic model of obsolescence management for long life cycle embedded system maintenance.**

For products like automotive, avionics, military application etc., the desired life cycles for these systems are many times longer than the obsolescence cycle for the electronic components used in the systems. Components obsolescence problems occur in all systems with a life cycle longer than that of one or more of their components.

Electronic Industries Association (EIA) has defined Gaussian distributions as their standardized product life cycle (PLC) curve. The model presented in this paper considers redesign and last-time-buy (LTB) as two management methods. LTB cost is estimated by unit cost, demand quantities, safety margin, interest rate and holding cost. Redesign cost associate with component type and quantities. Commercial components database like CAPS Expert from PartMiner can be used to get components life cycle data and status.

This model can estimate minimized management costs for different system architecture. The model consists of two parts. First part is to generate a graph which is in the form of state transfer diagram in Matlab. A segments table is then output from Matlab for further optimization. Finding the lowest cost in the model can be viewed as a transshipment problem. Linear programming (LP) is used to calculate the minimized management cost and management schedule, which is solved by Lingo.

A simple CAN controller system case study is shown to apply this model. The system contains a microcontroller and a CAN controller used in industrial construction machinery. This type of long life cycle system requires greater consideration to be given to maintenance. The model is validated by a set of synthetic and experimentally selected values. A minimized management cost and an optimized management time schedule are given as the result. Test experiments of maintenance cost responding to interest rate and unit cost are implemented. The responses of the model from the experiments meet our expectation.

The model we built right now contains a lot of simplifications and has a limitation of 2 components. The experiment is implemented with assumed parameters values. The uncertainties for real world application are not considered also. However, it is an initial step before we expand it and verify it with real industry statistical data. Although the model has lots of simplifications and limitations, it can give management strategy guidance to the designers who suffer from component obsolescence problems.