

## RESEARCH ON PRODUCT DEVELOPMENT ITERATIONS BASED ON FEEDBACK CONTROL THEORY IN A DYNAMIC ENVIRONMENT

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**ABSTRACT.** *The complicated interactions among tasks lead to iterations in product development and unexpected disturbances may destabilize the entire product development process. This paper makes an investigation on disposing product development iterations in a dynamic environment. Firstly, the uncertain factors, such as task durations, output branches of tasks, and resource allocations, existing in product development are discussed. Secondly, a satisfaction degree-based feedback control approach is put forward. Such an approach includes two scenarios: identifying a satisfaction degree and monitoring and controlling of iteration process. The former is used to represent the accepted iterative development process and the latter is realized by a resource regulating matrix based on feedback control theory. Finally, an example of a crane development project is provided to illustrate and verify the proposed approach.*

**Keywords:** Design structure matrix (DSM), Feedback control theory, Fuzzy satisfaction degree, Product development iteration

1. **Introduction.** Product development and innovation has become a key link to obtain competitive advantage for modern enterprises in recent years. To maintain the market share, enterprises should effectively manage their product development project and bring their products to market as early as possible. However, as we all know, the interdependencies among development tasks give rise to complex information flows as the execution of a development task may create new information or conditions that affect other interdependent tasks. As information flow is also random, and all the coupled tasks are executed concurrently, development decision made using incomplete or imperfect information are revisited in what is termed development iteration [1]. Osborne [2] found that iteration accounted for between one third and two thirds of total development time for projects at a major semiconductor producer. He also found that unpredictable iteration is the main cause of variability in the lead times of projects at this firm. Therefore, it is necessary to explore iterative development process. Moreover, in practice, each product development project is usually unique in nature [3]. It often encounters situations where the duration of particular tasks cannot be given precisely at the project initialization stage. Unless a product development project being scheduled is similar to previous projects, previous experience is of limited relevance [4]. It means that the durations of tasks are of uncertainty at the initial stage of product development process. In addition, when a