

# Integration of Technology Evolution Trends and Genetic Operation Trees for the Generation of Innovative Alternatives

吳誌銘, 余文德, 鄭紹材, Hao-rong Lou

Construction Management

Architecture

shaotsai@chu.edu.tw

## Abstract

Civil and construction engineering was considered as relatively slowly and lowly innovated areas for advancement of technology compared with other areas such as information and communication technology (ICT), bio technology, etc. Restriction of regulations and lack of efficient tools are two major causes hindering the innovation. Computer aided innovation (CAI) is a promising approach to improve the innovation of construction technologies. However, effective generation of innovative alternatives was considered the major bottleneck in implementing CAI for construction technologies. This paper proposes a novel approach that integrates both trends of technology evolution (TTE) and genetic operation tree (GOT) to provide an automated method for generation of innovative alternatives. The proposed method adopts subject-action-object (SAO) function model as building blocks for technology modelling. The SAO model is then transformed into GOT for evolution. The TTE is built in the evolution algorithms of GOT based on a specialized fitness function. The innovative alternatives are automatically generated with sGA. Finally, the generated innovative alternatives are validated by domain experts. A seismic isolation-layer pipeline technology is selected for case study to demonstrate the feasibility of the proposed method. It is found that the proposed method is efficient in generation of effective innovative alternatives for construction technologies. The proposed method described in this paper provides a first-of-its-kind automated tool for alternative generation of CAI. While integrated with TTE and GOT techniques, a self-evolution model for technology innovation is proposed and developed. With such a model, not only more automatically the alternatives are generated but also more radical ideas can be created. It is concluded that the result of the research has created a brand new area for technology

advancement of civil and construction engineering.

Keyword : Trends of evolution, genetic operation tree, technology innovation.