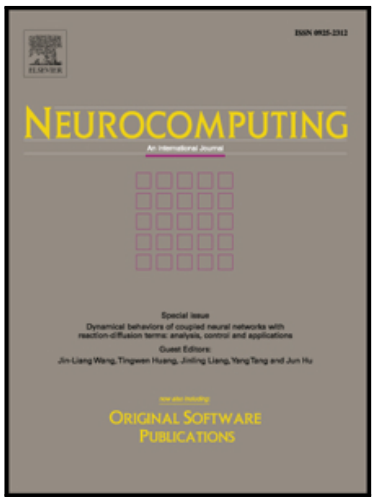

A Method to Learn High-Performing and Novel Product Layouts and its Application to Vehicle Design

Victor Parque, Tomoyuki Miyashita

PII: S0925-2312(17)30433-2
DOI: 10.1016/j.neucom.2016.12.082
Reference: NEUCOM 18183

To appear in: *Neurocomputing*

Received date: 30 June 2016
Revised date: 29 November 2016
Accepted date: 3 December 2016

Please cite this article as: Victor Parque, Tomoyuki Miyashita, A Method to Learn High-Performing and Novel Product Layouts and its Application to Vehicle Design, *Neurocomputing* (2017), doi: 10.1016/j.neucom.2016.12.082

A Method to Learn High-Performing and Novel Product Layouts and its Application to Vehicle Design

Victor Parque and Tomoyuki Miyashita

parque@aoni.waseda.jp, tomo.miyashita@waseda.jp

Department of Modern Mechanical Engineering, Waseda University

3-4-1 Okubo, Shinjuku-ku, Tokyo 169-8555, Japan

Abstract

In this paper we aim at tackling the problem of searching for novel and high-performing product designs. Generally speaking, the conventional schemes usually optimize a (multi) objective function on a dynamic model/simulation, then perform a number of representative real-world experiments to validate and test the accuracy of the some product performance metric. However, in a number of scenarios involving complex product configuration, e.g. optimum vehicle design and large-scale space-craft layout design, the conventional schemes using simulations and experiments are restrictive, inaccurate and expensive.

In this paper, in order to guide/complement the conventional schemes, we propose a new approach to search for novel and high-performing product designs by optimizing not only a proposed novelty metric, but also a performance function which is learned from historical data. Rigorous computational experiments using more than twenty thousand vehicle models over the last thirty years and a relevant set of well-known gradient-free optimization algorithms shows the feasibility and usefulness to obtain novel and high performing vehicle layouts under tight and relaxed search scenarios.

The promising results of the proposed method opens new possibilities to build unique and high-performing systems in a wider set of design engineering problems.

Keywords: design, vehicle, optimization, genetic programming, gradient-free optimization