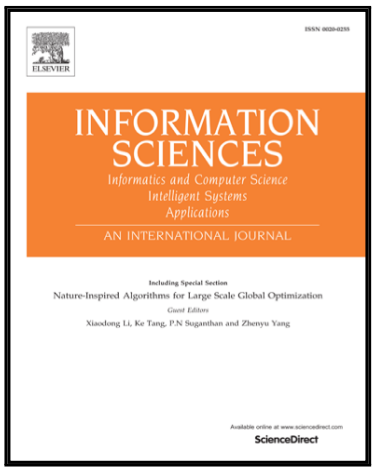

A generalized type-2 fuzzy logic approach for dynamic parameter adaptation in bee colony optimization applied to fuzzy controller design

Oscar Castillo , Leticia Amador-Angulo

PII: S0020-0255(17)31028-9
DOI: 10.1016/j.ins.2017.10.032
Reference: INS 13207

To appear in: *Information Sciences*

Received date: 30 March 2017
Revised date: 10 October 2017
Accepted date: 13 October 2017

Please cite this article as: Oscar Castillo , Leticia Amador-Angulo , A generalized type-2 fuzzy logic approach for dynamic parameter adaptation in bee colony optimization applied to fuzzy controller design, *Information Sciences* (2017), doi: 10.1016/j.ins.2017.10.032

A generalized type-2 fuzzy logic approach for dynamic parameter adaptation in bee colony optimization applied to fuzzy controller design

Oscar Castillo*, Leticia Amador-Angulo
Division of Graduate Studies and Research
Tijuana Institute of Technology Tijuana, México
*Email: ocastillo@tectijuana.mx

Abstract. In this work a Generalized Type-2 Fuzzy Logic System (GT2FLS) approach for dynamic parameter adaptation in metaheuristics and for optimal fuzzy controller design is presented. In these two cases, the efficiency of the GT2FLS approach is verified with simulation results. In the first case, the GT2FLS provides an approach to dynamically find the optimal values of the heuristic parameters that are a critical part of the Bee Colony Optimization (BCO) algorithm performance. In the second case, the GT2FLS approach provides the basis for building a Generalized Type-2 Fuzzy Logic Controller (GT2FLC), which can be optimized with the traditional BCO, specifically to find the optimal design of the Membership Functions (MFs) in the Fuzzy Controller. In both cases, the GT2FLS approach shows advantages in the optimization of the solutions to the problems. For both cases, we can considered them as hybrid systems combining GT2FLS and BCO although the combination is made in a different way, and it can be noted that a GT2FLS presents better stability in the minimization of the errors when applied to benchmark control problems. Simulation results illustrate that the implementation of the Generalized Type-2 Fuzzy Logic Controller (GT2FLC) approach improves its performance when using the BCO algorithm and the stability of the fuzzy controller is better when compared with respect to a Type-1 Fuzzy Logic Controller (T1FLC) and an Interval Type-2 Fuzzy Logic Controller (IT2FLC).

***Index Terms*—Generalized Type-2 Fuzzy Logic System, Mathematical Functions, Fuzzy Controllers, Uncertainty, Bee Colony Optimization Algorithm.**