ANTIFRAGILE DESIGN OF SELF-IMPROVING SYSTEMS

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Abstract. *The purpose of this paper is to highlight how the concept of antifragility can be introduced in the design stage of self-improving systems, considered as complex adaptive systems capable of maintaining the functionality at optimal parameters under adverse conditions caused by unforeseen changes in context. Assuming that an antifragile system not only maintains its robust behavior when faced with stressful and harmful events, but even benefits to optimize its performance, the paper offers a detailed description of the features that must be ensured when designing a self-improving system.*

Keywords: antifragile, resilience, robustness, self-improvement, complexity, self-adaptive, context-aware, uncertainties, decision-making.

2. Introduction

Antifragility is a concept introduced and developed by Nassim Nicholas Taleb in his book "Antifragile: Things That Gain from Disorder" [1]. The term "antifragility" appears about 5 years after Taleb made a "revolution" in the way of referring to rare, unlikely events, which he calls "black swans" and which he defines through three essential characteristics: 1) they are difficult to predict, almost impossible; 2) they are easy to explain in retrospect, that is, after they have been reported; 3) they have a very pronounced impact in different environments of high complexity. Taleb points out that "black swans" cannot be characterized stochastically by Gaussian distributions, because they are far from average. Although these events can have a positive impact on the evolution of processes, usually by contributing to the stabilization of feedback loops, and thus leading to increased robustness of the process, there are situations where the effect is opposite and may lead to systems "weakening" due to unwarranted trust leading to the neglect of safety policies. To use only positively the impact of black swans, Taleb introduces the concept of antifragility as an alternative design criterion for a system with a high degree of robustness. In short, antifragility refers to systems that improve their behavior when subjected to exaggerated and slightly plausible parameter changes. Another important difference is that an antifragile system acts preventively, before the critical event occurs, while a robust system focuses on

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