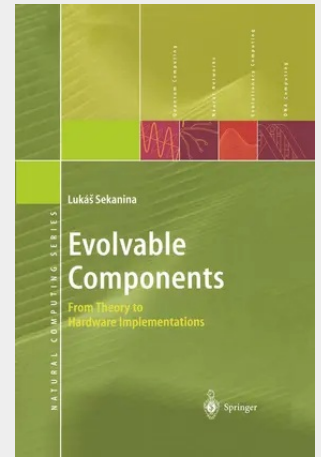


Evolvable Components

From Theory to Hardware Implementations

An authoritative account of adaptive evolvable systems operating in a changing environment. The proposed component approach for the design of evolvable systems, the mathematical theory of evolvable machines, and the idea of virtual reconfigurable circuits have opened a way towards a better understanding of evolvable systems and to the design of more adaptive, competitive and innovative engineering products. In particular, topics such as the computational power of evolvable systems, the design of complex human-competitive digital circuits and the implementation of a one-clock partial reconfiguration in a common field-programmable gate array are introduced, investigated and implemented. The application domain is the adaptive image preprocessing.

At the beginning of the 1990s research started in how to combine soft computing with reconfigurable hardware in a quite unique way. One of the methods that was developed has been called evolvable hardware. Thanks to evolutionary algorithms researchers have started to evolve electronic circuits routinely. A number of interesting circuits - with features unreachable by means of conventional techniques - have been developed. Evolvable hardware is quite popular right now; more than fifty research groups are spread out over the world. Evolvable hardware has become a part of the curriculum at some universities. Evolvable hardware is being commercialized and there are specialized conferences devoted to evolvable hardware. On the other hand, surprisingly, we can feel the lack of a theoretical background and consistent design methodology in the area. Furthermore, it is quite difficult to implement really innovative and practically successful evolvable systems using contemporary digital reconfigurable technology.



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