

The Use of Artificial Intelligence Methods for Time Delay Systems Control

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Abstract:

Systems comprising internal delays represent a class of systems with a very complex dynamics characterized by an infinite spectrum, specific responses and characteristics in time and frequency domains. Tasks of their control often require the use of unusual solutions that are very specific, unlike conventional approaches known for undelayed systems. The presence of delays significantly influences the feedback dynamics; especially, it has a decisive impact to stability that can be sensitive to even small delay value changes.

A considerable amount of the existing solutions of time delay controller synthesis is based on highly advanced mathematical operations from the field of matrix calculus or calculus of variations, which (from the engineering point of view) makes their practical applicability more difficult or even impossible.

For the above-introduced tasks, it provides the use of artificial intelligence optimization methods that are mostly mathematically not very complicated, easily programmable and may provide real-time results. The goal of the PhD thesis is to suggest solutions of several problems related to stability attainment, an optimal controller design and tuning etc. The solutions are supposed to be based on advanced approaches and techniques of artificial intelligence and to be engineeringly utilizable. It is also supposed that not only some existing algorithms will be implemented but also their modifications concerning specific features of time delay systems will be proposed. The techniques are to be verified and validated via a suitable software tool as well as through a laboratory appliance.

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