Implementation of safe experimentation spiral dynamics algorithm for self-tuning of PID controller in elastic joint manipulator

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ABSTRACT
This paper exclusively endorses the optimization of self-tuned PID using Safe Experimentation Spiral Dynamic Algorithm (SESDA) for elastic joint handling. SESDA is hereby devised by adoption of spiral function to a standard Safe Experimentation Dynamics Algorithm (SEDA). Such modification is implemented to exploit the ability of spiral function in enhancing both the algorithm's exploration competency and convergence accuracy. Rotating angle tracking and vibration were then commanded by employing a pair of self-tuned PID controllers to the elastic joint system in appraising the optimization efficacy of SESDA. Performance of the updated self-tuned PID controller was further assessed in accordance to the recorded outputs on angular motion trajectory tracking, vibration suppression and statistical evaluations centering its pre-established control fitness function. The proposed SESDA produced 6.51 %, 5.54 % and 8.51 % improvement of fitness function, tracking error and control input energy, respectively, as compared with the standard SEDA. Acquired results ultimately confirmed the excellence of SESDA towards self-tuned PID's superior regulatory precision against the standard SEDA as well as its variants.

KEYWORDS
Data-based approach; Flexible structure; PID; Self-tuned handling; Vibration suppression

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