EDITORIAL

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This issue of Computación y Sistemas Mathers six articles, five of them in the mechatronics domain, and one focused on a computational geometry problem. Also a PhD thesis summary is presented.

The paper “Task Based Mechatronic System Design using Differential Evolution Strategies”, with Cruz-Villar, Álvarez-Gallegos y Villarreal-Cervantes as its authors, proposes an interesting method for the design of a mechatronics system that, contrary to the usual approaches, takes into account the task to be executed by the electro-mechanical system. The method chooses the parameters, both for the mechanical system and the associated control system, via the resolution of a non-linear dynamic optimization problem using evolutionary algorithms. A diferential evolution strategy with constraint handling is used as optimization algorithm. The usefulness of the method is demonstrated in its application to the design of a five-bar parallel robot, with PID controllers, where the length of the links and the controller gains are the parameters to be optimized. Thanks to this proposal, the time necessary for the design of a mechatronic system can be significantly reduced, although a dynamic model of the parallel robot that represents properly the real system is mandatory.

The paper by Sira-Ramírez, Barrios-Cruz and Marqués-Contreras, entitled “Fast Adaptive Trajectory Tracking Control for a Completely Uncertain DC Motor via Output Feedback”, presents an algebraic method for the identification of unknown parameters in dynamic systems, more specifically in DC motor models. As a result, a linear system of time-varying equations is obtained, which is independent on the initial conditions and load perturbations, and from which the unknown parameters can be easily computed just from the measured inputs and outputs. Upon this basis, a fast adaptive online GPI (Generalized Proportional Integral) controller with output feedback is synthesized, and it is applied to the tracking of an angular velocity reference trajectory.

García, Cárdenas, Rendón and Maya-Méndez, in “A Vision based control platform for Industrial Robot Rehabilitation”, face the goal of reducing the costs associated to the use of robots for industrial tasks. They propose a vision-based control platform that allows the development of more flexible robots and the recuperation and rehabilitation of outdated robots via the replacement of their original controller. This approach was applied to a PUMA 761 robot. For the calibration of the vision-based controller they propose the use of the CSM technique, which has the advantage of not being sensible to errors in the kinematic model of the robot due to moderate mechanical deterioration of the components. The paper provides details about the architecture of the vision platform, and the results of its empirical evaluation in robot positioning tests, suggesting the applicability of the approach in tasks where position tolerance is around 1.5 mm.

The work by de Peza-Solís, Silva-Navarro and Castro-Linares, entitled “Modeling and Tip Position Control of a Flexible Link Robot: Experimental Results”, presents a method for the control of the tip position in a flexible link robot (a long and thin aluminum beam), clamped to the shaft of a DC motor, with movement in a horizontal plane. The proposed mathematical model considers the excitation of the link up to its first three vibration modes. Starting from these results, two control schemes have been designed which prove to provide good results in an experimental setting. On the one hand, a passive output is used relating the input torque applied to the link by the motor to the angular velocity of the tip, combined with a strictly passive compensator that stabilizes the system. On the other hand, a control scheme based on strain feedback is used, which is simpler and easier to use and provides better results.

The paper by Aguilar-Ibáñez, Gutiérrez-Frías and Suárez-Castañón, with title “Controlling the Strongly Damping Inertia Wheel Pendulum via Nested Saturation Functions”, tackles the problem of stabilizing an inertia wheel pendulum, with strong damping, around its unstable equilibrium point. In order to do so the authors propose the use of nested saturation functions, this made possible by the set of proposed transformations on the original system, and also taking into account the effect of damping force, an advancement from previous proposals. The solution is tested in a computational simulation.

With a thematic area different from the previous papers we find the article “Visibility of limited rage in staircase polygons”, by Canales-Cano and Hernández-Peñalver, focused in the so called “art gallery problem”, that is the problem of determining how many lights (or guardians) are sufficient to illuminate (or watch) every inner point of a polygon. Here the problem is modified to allow lights with a limited range. It is presented the way to determine the minimum number of lights with a given range that is necessary to completely illuminate staircase polygons, considering that lights are situated on the vertices of the polygon.

Finally, Cruz Pérez, Guevara López and Medel Juárez, describe a mathematical model for the representation of arrival times of concurrent Real-time task. Additionally, a stability analysis is proposed.

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