THE VERSATILE INTELLIGENT PORTABLE ROBOT PLATFORM APPLIED TO HUMAN AID MECHATRONICS

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Abstract: The paper presents research and experimental development of the VIP RO Versatile Intelligent Portable Robot Platform using the dynamic hybrid force-position control in order to improve the motion and stability performances of the Human Aid Mechatronics Systems in virtual and real environments on unstructured and uneven terrain. We are proposing the development of a VIP RO platform through an original method of virtual projection with applications in improving human life quality, recuperation and social reintegration of the disabled, improving life quality for the elderly.

Versatile Intelligent Portable Robot Platform

The VIP RO dynamic versatile intelligent portable robot platform is developed through a multi-disciplinary concept using the 3D virtual representation with high graphic processing power and advanced programming languages through the mechanical structure modeling, an open architecture system **keeping the robot classic control system** (with embedded software) and of the intelligent control interfaces (fuzzy control, multi-agent control, dynamics and adaptive control, robust and iterative learning control, etc.) implemented through IT&C techniques on fast and high data processing.

In order to carry out new capabilities the VIP RO platform we have develop a high-level intelligent algorithms for the dynamic control using ZMP and inertial information, pattern generation of compliant walking, real-time ZMP compensation, the leg joint damping control, stable stepping control and stepping position control based on angular velocity of the platform. The improvement of the VIP RO platform performances is developed through optimization of certain intelligent control methods: **Robot Neutrosophic Control (RNC)** by applying neutrosophic logic and Dezert Smarandache Theory (DSmT), representing a new theory that merges the fuzzy theories and information fusion [1], **Human Adaptive Mechatronics method** that able adapt themselves to the human's skill in various environments and providing assistance in improving performances [2], **Petri Net and Markov Chains Approach** for dynamic control of the walking robots motion in a more efficient concurrency control [3]. The VIP RO real time control system with Open Architecture (OAH) ensures flexibility, short time execution with precision targeting and repeatability of the motion and developments to increase the performances.

Results and Conclusions

The novelty VIP RO platform will be able to be sold in competition with other similar virtual simulation platforms, called virtual instrumentation: CDA, CAM, CAE, Solid Works or MatLab, Simulink, COMSOL, also allowing the design, testing and experiment of intelligent control methods on a real robot control system.

An application example is a hip joint simulator which play an important role in preclinical validation of biomaterials used for orthopedic implants and are necessary to perform wear tests on biomaterials prior the implantation in the human body in order to obtain quality control and to acquire further knowledge as to the tribological processes that involve joint prostheses.

The VIP RO versatile intelligent portable robot platform is expected to be applied in developing human aid mechatronics in various fields such as rehabilitation support and physical training support in medical field, ADL support for disabled people, rescue support at disaster sites.

3. References

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