DOWNLOAD PDF MODELING IDENTIFICATION AND CONTROL OF ROBOTS

Chapter 1 : Modeling, Identification and Control of Robots : W. Khalil :

No other publication covers the three fundamental issues of robotics: modelling, identification and control. It covers the development of various mathematical models required for the control and simulation of robots.

Model Learning for Robot Control: It is widely believed that intelligent mammals also rely on internal models in order to generate their actions. However, while classical robotics However, while classical robotics relies on manually generated models that are based on human insights into physics, future autonomous, cognitive robots need to be able to automatically generate models that are based on information which is extracted from the data streams accessible to the robot. In this paper, we survey the progress in model learning with a strong focus on robot control on a kinematic as well as dynamical level. Here, a model describes essential information about the behavior of the environment and the influence of an agent on this environment. In the context of model based learning control, we view the model from three different perspectives. First, we need to study the different possible model learning architectures for robotics. Second, we discuss what kind of problems these architecture and the domain of robotics imply for the applicable learning methods. From this discussion, we deduce future directions of real-time learning algorithms. Third, we show where these scenarios have been used successfully in several case studies. In this paper, we present a general method to calculate the inverse and direct dynamic models of parallel robots. The models are expressed in a closed form by a single equation in which all the elements needed are expressed. The solution is given in terms of the dynamic models of the legs, The solution is given in terms of the dynamic models of the legs, the dynamics of the platform and some Jacobian matrices. The proposed method is applied in this paper on two parallel robots with different structures. Show Context Citation Context Efficient factorization of the joint-space inertia matrix for branched kinematic trees by Roy Featherstone - International Journal of Robotics Research , " This paper describes new factorization algorithms that exploit branch-induced sparsity in the joint-space inertia matrix JSIM of a kinematic tree. It also presents new formulae that show how the cost of calculating and factorizing the JSIM vary with the topology of the tree. These formulae show th These formulae show that the cost of calculating for-ward dynamics for a branched tree can be considerably less than the cost for an unbranched tree of the same size. Branches can also reduce complexity; some examples are presented of kinematic trees for which the complexity of calculating and factorizing the JSIM are less than O n2 and O n3 , respectively. Finally, a cost comparison is made between an O n algorithm and an O n3 algorithm, the latter incorporating one of the new factorization algorithms. This is due mainly to the O n3 algorithm running about 2. Abstractâ€"This paper presents a feedback controller that allows MABEL, a kneed planar bipedal robot with 1 m-long legs, to accommodate terrain that presents large unexpected increases and decreases in height. The robot is provided information on neither where the change in terrain height occurs, nor The robot is provided information on neither where the change in terrain height occurs, nor by how much. A finite-state machine is designed that manages transitions among controllers for flat-ground walking, steppingup and down, and a trip reflex. The change in height can be used to invoke a proper control response. The design of each control mode and the transition conditions among them are presented. The paper concludes with experimental results of MABEL blindly accommodating various types of platforms, including ascent of a An impact occurs when the swing leg touches the ground, and is modeled here as an inelastic contact between two rigid bodies. It is assumed that there is neither rebound nor slip at impact. Abstract â€" Recently, several controllers have been proposed for humanoid robots which rely on full-body dynamic models. The estimation of inertial parameters from data is a critical component for obtaining accurate models for control. However, floating base systems, such as humanoid robots, incur ad However, floating base systems, such as humanoid robots, incur added challenges to this task e. In this work, we outline a theoretical framework for whole body inertial parameter estimation, including the unactuated floating base. Using a least squares minimization approach, conducted within the nullspace of unmeasured degrees of freedom, we are able to use a partial force sensor set for full-body estimation, e. We also propose how to determine the theoretical minimum force sensor set for full body estimation, and discuss the practical limitations of doing so. In these works, motion and forces are recorded while the robot executes sufficiently exciting trajectories. Then, inertial parameters such as mass, center of mass, inertia tensors can be f It also presents new formulas that show how the cost of calculating and factorizing the JSIM vary with the topology of the tree. These formulas show th These formulas show that the cost of calculating forward dynamics for a branched tree can be considerably less than the cost for an unbranched tree of the same size. Branches can also reduce complexity; and some examples are presented of kinematic trees for which the complexity of calculating and factorizing the JSIM are less than O n 2 and O n 3 , respectively. Finally, a cost comparison is made between an O n algorithm and an O n 3 algorithm, the latter incorporating one of the new factorization algorithms. This is due mainly to the O n 3 algorithm running about 2. In this paper, previous works on nonlinear H control for robot manipulators are ex-tended. In particular, integral terms are considered to cope with persistent disturbances, such as constant load at the end-effector. The extended controller may be understood as a computed-torque control with an ext The extended controller may be understood as a computed-torque control with an external PID, whose gain matrices vary with the po-sition and velocity of the robot joints. In addition, in order to increase the controller ro-bustness, an extension of the algorithms with saturation functions has been carried out. This extension deals with the resulting nonlinear equation of the closed-loop error. A modified expression for the required increment in the control signal is provided, and the local closed-loop stability of this approach is discussed. Finally, simulation results for a two-link robot and experimental results for an industrial robot are presented. The results obtained with this technique have been compared with those attained with the original controllers to show the improvements achieved by means of the proposed method. This research identifies an eleven degree of freedom dynamic model of MABEL, a new robot for the study of bipedal walking and running. The identification process is modular and begins with the cable-driven transmission mechanism of the robot. By blocking an appropriate pulley, the springs that are part of the transmission can be removed from the initial portion of the identification process. Furthermore, by selectively connecting and disconnecting cables in the transmission, experiments are designed for each actuated coordinate in order to determine inertias, friction coefficients, motor constants, and power amplifier biases of the transmission system. These a priori estimates are initially validated by comparing predicted response of the combined legs and transmission system to experimental data excited by common torque commands. At this point, the compliant elements in the transmission are brought back into the system and are identified with a set of static experiments. Specifically, spring stiffness is estimated from the spring torques and deflections. A second unplanned source of compliance is accounted for next. This compliance arises when the cables connecting the pulleys in the transmission stretch under heavy loads. The overall model of the robot is validated through a hopping experiment that excites all of the dynamics of the model. Robot , " Abstract In this article, we present an integrated ma-nipulation framework for a service robot, that allows to interact with articulated objects at home environments through the coupling of vision and force modalities. We consider a robot which is observing simultaneously his hand and the object to We consider a robot which is observing simultaneously his hand and the object to manipulate, by using an external camera i. Task-oriented grasping algo-rithms [1] are used in order to plan a suitable grasp on the object according to the task to perform. The coupling be-tween these two complementary sensor modalities pro-vides the robot with robustness against uncertainties in models and positioning. A position-based visual servoing control law has been designed in order to continuously align the robot hand with respect to the object that is be-ing manipulated, independently of camera position. This allows to freely move the camera while the task is being executed and makes this approach amenable to be in-tegrated in current humanoid robots without the need of hand-eye calibration. Experimental results on a real robot interacting with different kind of doors are pre-sented. Hybrid control separates vision control and force control into two separate control loops, that operate in orthogonal directions. With this approach, it is not possible Abstractâ€”This paper deals with the problem of dynamic modeling and identification of passenger

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cars. It presents a new method that is based on robotics techniques for modeling and description of tree-structured multibody systems. This method enables us to systematically obtain the dynamic identifica This method enables us to systematically obtain the dynamic identification model, which is linear with respect to the dynamic parameters. The estimation of the parameters is carried out using a weighted least squares method. The method has then been used to estimate the dynamic parameters of an experimental Peugeot , which is equipped with different position, velocity, and force sensors. Index Termsâ€"Identification, mobile robot dynamics, modeling, passenger car.

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A. Janot, P. O. Vandanjon, M. Gautier, Identification of robots dynamics with the instrumental variable method, Proceedings of the IEEE international conference on Robotics and Automation, p, May , , Kobe, Japan.