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A 3-D simulation of unicycle robot based on virtual prototyping technology.

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Summary: Co-simulation of ADAMS and MATLAB for designing and developing mechatronics and control system is presented in this paper. The co-simulation technology provides an avenue for realizing mechatronics system design loop and control system design synchronously without the need for building prototypes. The virtual prototype developed in ADAMS can be used to investigate dynamic behavior in a 3-dimensional environment. Though ADAMS has the capability of implementing a closed loop control of the virtual prototype, its capability is quite restricted. On the other hand, MATLAB is well known for designing control systems. Co-simulation allows us to get the benefit of both. The co-simulation platform was used to verify different features of a unicycle robot. Mechanical drawings of the robot are first created using CAD software, e.g., SOLIDWORKS and imported into the ADAMS. Dynamics of the robot in autonomous mode are simulated using the co-simulation platform in which the controller is designed and implemented using MATLAB. Simulation results can then be used to modify mechanical design and improve the control method. Although the virtual platform is tested for one specific system, it can be easily used for design of other mechatronics systems and control methods e.g., model free control, learning control and developmental robotics.

Keywords: unicycle robot; virtual prototyping technology; co-simulation; PID controller
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