Hybrid AI/Control System Interactions and Analysis

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This paper discusses the nature of interactions between high-level intelligent agents and low-level control algorithms. Control algorithms offer the promise of simplifying a system's dynamic behaviour as perceived by the controlling agent, thus considerably simplifying the agent's tasks of planning and execution. However, the coupled dynamics of such a hybrid system can be difficult to predict and may even lead to undesirable behaviour. This paper demonstrates that it is possible for a rational intelligent agent commanding a system with a well-designed control algorithm to cause catastrophic behaviours, and presents a framework for analysing the coupled dynamics of hybrid systems. A technique for alleviating these behaviours is suggested, using newly developed control algorithms applicable to a wide variety of autonomous systems of current interest. These controllers can also themselves be made adaptive, allowing for the possibility of 'distributed' or 'co-operative' learning and reasoning. As the control algorithm learns models of the physical system, this information can be passed back to the controlling agent, allowing it to alter its goals and strategies accordingly. A new architecture for hybrid systems encapsulating these ideas is then suggested.