Part III
Coordination of Behaviors

The chapters in this part are concerned with the problem of behavior coordination: how to coordinate the simultaneous activity of several independent navigation behaviors in order to obtain an overall coherent behavior that achieves the intended navigation task. In this context, attention is paid to how fuzzy logic based decision schemes can be used to solve the two conceptually different problems of behavior arbitration and of command fusion.

The chapter by Pin and Watanabe is mainly focused on issues of command fusion in the case of conflicts between simultaneously activated fuzzy rules within one and the same behavior, and of conflicts between simultaneously activated individual behaviors. A context independent approach, based on the two concepts of behavior suppression and behavior inhibition, is proposed as a remedy.

The next two chapters describe different realizations of the so called context dependent blending, in which fuzzy logic is used for both behavior arbitration and command fusion. The chapter by Goodridge and Kay describes a modular fuzzy control architecture based on the decomposition of the control of a navigation task into a number of interacting control agents. The arbitration between agents is achieved by introducing additional fuzzy rules which coordinate switches in motion behavior in a context-sensitive manner. The chapter by Tunstel presents a hierarchical control architecture consisting of multiple sets of fuzzy rules, each rule-set encoding a sensor-based motion behavior or a context-dependent assignment of activation levels to motion behaviors. Interesting, Tunstel also discusses the use of genetic programming to learn multi-behavior arbitration rules.

The final chapter of this part, by Pirjanian and Matarić, relates fuzzy command fusion to multiple objectives decision making. It is argued that behavior conflict resolution using fuzzy inference and defuzzification can generate undesirable results. As an alternative, the authors propose a multiple objective behavior coordination approach which provides useful formal tools for describing, characterizing, and solving behavior conflicts in a principled manner. It is shown that that multiple objective behavior coordination can be embedded into a fuzzy behavior based system to replace fuzzy inference and defuzzification.