

SUMMARY OF Ph.D. DISSERTATION

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| School Integrated Design Engineering | Student Identification Number | SURNAME, First name TSUJI, Toshiaki |
| <p>Title</p> <p style="text-align: center;">Motion Control for Adaptation to Human Environment</p> | | |
| <p>Abstract</p> <p>From now on, motion control will play more important role due to industrial development of robots and electric vehicles. They are supposed to work in human environment in the near future. Hence this study aims at improving adaptability of robots to human environment while the issue has many factors. The author categorized the factors into three parts shown as follows:</p> <ul style="list-style-type: none"> ● sophisticated motion planning; ● flexible controller design; and ● robust motion control. <p>Chapter 1 summarizes the background and related studies.</p> <p>Chapter 2 describes some methods for a biped robot working in human environment. The studies show importance of motion planning in known environment. On the other hand, compliance control is requisite for a robot in unknown environment while it may degrade tracking performance. A hybrid control system based on environmental modes acquires both environmental adaptability and tracking performance.</p> <p>A method to design such a hybrid control system is proposed in the next place. The method should have flexibility to deal with exceptions and environmental variation. The method should also be for a large-scale system since a robot in human environment needs hyper-DOF. The idea of functionality provides a design framework for a large-scale system that deals with exceptions and environmental variation in a unified manner. The study implies that the concept of "controller design as combination of detachable components" will be a key for a robot in human environment. The method is firstly proposed in Chapter 3 for bilateral control. The method is secondly extended to decentralized control in Chapter 4.</p> <p>Chapter 5 proposes a velocity measurement method for robust acceleration control. The method is named Synchronous-measurement method(S method). Acceleration control is indispensable for a hybrid control system based on functionality since acceleration is a useful tool to represent both position and force. Furthermore, robust acceleration control enhances contact stability to human environment. Although S method is a fundamental technique for all motion control systems with optical encoder, it is particularly effective for acceleration control systems.</p> <p>Chapter 6 summarizes the result of this study.</p> | | |