論文要旨

It is urgent to develop response robots that can be utilized not only in wide-area natural disasters and accidents but also in disaster sites. Due to the growth of the robot market, shortening of the development cycle and performance evaluation items are increasing not only in response robot development but also in general needs robot development. The robot development procedure is changing. Introduction of simulation to robot performance evaluation in robot development. Due to improved performance of computers, simulation utilization methods have diversified. Since we can use a high-performance computer hardware and a high-performance simulation software, we must be able to utilize simulation with more kinds of robot performance evaluation. The concept of this study is proposing necessary factors to utilize simulation for robot performance evaluation. Advantages of using simulation for robot performance evaluation include the following features. These features are effective as shortening of development cycle and correspondence to robot high output.

Chapter 1 described the importance of simulated robot evaluation and the relationship between robot evaluation and some real environment factors with some actual examples from some major robot competitions.

Chapter 2 showed a sample exercise simulation field for robot operators, and we knew a robot operator team could have team exercise time in a simulation platform. Communication between operators is important in multiple robots operations especially at places that robots are hard to pass. Pairing members from good skill group is better than pairing from all, and performances of a better operator leads the pair are better than the performance that the other operator leads the pair.

Chapter 3 showed that we can generate differential difficulty obstacle, and we knew that SLAM generates a better map depending on the terrain without corrected range information. An evaluation field for evaluating the performance of rescue robot using simulation was proposed, and in experiments involving mapping with SLAM, results of experiments showed that the SLAM results done on rough terrain compared to SLAM results on flat floor are distorted and difficult to read results. It showed the effectiveness of the proposed evaluation field.

Chapter 4 showed a simulated fluctuating Wi-Fi radio behavior and a sample simulation platform with Wi-Fi environment. And we knew we could make some fluctuated Wi-Fi zone to evaluate autonomous ability. We saw two experiments to demonstrate the effectiveness of proposed method. The first experiment revealed that our radio-wave fluctuation simulation closely matched the actual fluctuation behavior. The second experiment showed that proposed Wi-Fi simulation of the simultaneous fluctuation and diffraction of the Wi-Fi signal behavior resembled the actual signal behavior. The experiments showed that the proposed Wi-Fi test field considering the fluctuations of Wi-Fi signals can evaluate the response robots intended for use in disaster zones before they are actually deployed.

Chapter 5 presented a realistic simulation platform using sound, and discuss the importance of the sound information when performing operations and daily Infrastructure maintenance tasks. The prototype platform for reproduction of sound a sample representation of hammering test tasks. In the represented hammering task, the robot operator decides upon the next course of action based on sound information as same as in the real hammering task. And other prototype tasks were showed sound representations with noise from the environment incorporate an increasingly Difficulty. Those sound prototype platforms demonstrate that the use of sound makes robot simulation applications more realistic and robust.

From now on, reproduction of sound, heat, gas and vibration propagation will become important. We can believe

that this study can contribute to the development of research on robot evaluation in the future.