Automated Robot's Workspace Approximation

Mikhail Posypkin
Dorodnicyn Computing Centre, Federal Research Center “Computer Science and Control” of Russian Academy of Sciences
mposypkin@gmail.com

The workspace of a robot is defined as a set of positions that robot or its part can take. The workspace size maximization is often one of the design goals: the larger workspace the bigger area a robot can serve. A manual workspace determination can be a error-prone and time-consuming process. Thus there is a clear need for automating it.

In this work we propose an approach to cover of the working space of a robot with boxes. The interior an the boundary of the workspace are approximated with boxes with the prescribed accuracy. Two principally different ways of obtaining the coverage are considered. The first method obtains a coverage directly from robot’s kinematic equations. This approach requires minimal efforts from a user but entails a huge amount of computations for realistic robots. The second way consists in decreasing the number of parameters by reducing the system of kinematic equations to a system of inequalities. The the latter is used to construct a coverage. This approach results in more accurate approximations and requires less computational efforts. However reducing the system of equations to a system of inequalities is a non-trivial task and usually involves the human’s efforts.

We study and compare both ways of constructing the workspace approximation on model and realistic robotic systems. We show how high performance computing can significantly reduce the computational time needed to construct quality approximations.