

# **DEVELOPMENT OF DANCE PARTNER ROBOT -PBDR-**

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A Dance Partner Robot, PBDR (Partner Ball Room Dance Robot), dances a waltz as a female dancer together with a human male dancer. The waltz, a ball room dance, is usually performed by a male dancer and a female dancer. The dance consists of a certain number of steps, and transition of the steps, which is lead by the male dancer based on the transition rule of the dance. The step transition rule allows the male dancer to select a step from a class of steps determined for the current step so that the line of dance is traced. The female dance partner estimates the following step through physical interactions with the male dancer.

The design of the mechanism of the PBDR has been done together with a dress designer, Tastuya Oconogi. The robot mechanism, which has to be put into the robot body designed by the dress designer, is designed so as to have enough number of degrees of freedom for performing the dance. An upper body of the robot consists of two manipulators, each of which has four-degrees-of-freedom for forming a frame, and a head rotating around a neck. A lower body of the robot has an omni-directional mobile base having three degrees of freedom, which is attached to the upper body through a parallel link mechanism driven by three linear actuators. The upper body motion is realized by the parallel link mechanism.

The dance robot has a database about the waltz and its transition rule which is used to estimate the following dance step and generate an appropriate step motion. The step estimation is done based on the time-series data of the force/torque applied by the male dancer to the robot upper body. The robot motion is generated for the estimated step using the step motion in the database compliantly against the interface force/moment between the human dancer and the robot in real time. The estimation of the following step, however, could not be done perfectly. We are continuing the development of the robot, and current

version could watch the human's dance step all the time during the dance and if the step is different from the estimated one, the step is corrected according to the human's step. The development of the dance partner robot suggests us a lot of important issues for robots having interaction with a human. Why we are developing the dance partner robot and how the concept will be applied to other robot systems will be discussed in the presentation.