

# Utilization of Kinematical Redundancy of a Rehabilitation Robot to Produce Compliant Motions under Limitation on Actuator Performance

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**Abstract**— This paper addresses the mechanical structure and control method of a redundant drive robot (RDR) to produce compliant motions, and show how the design parameters of the RDR can effect the produced motions and the mechanical and performance limitations of the actuators of the RDR. The structure and control method of the RDR can have been proper to produce compliant motions, but the effect of the design parameters of the RDR to the mechanical and performance limitations have not been clear. Therefore, the feasibility of producing compliant motions in the case of the prototype of the RDR is confirmed by conducting simulations and experiments, and then the design parameters of the RDR to the mechanical and performance limitations are verified by

by Nagai *et al.* [11]. The paper also discussed the limitations imposed by actuator performance on the design of a prototype of RDJ-DA [12]. Goto *et al.* proposed an alternative RDR for producing 1 DOF motion at the endpoint, in which the two robotic joints are driven by the sum and difference of the two actuator torques [13]. The paper showed that it a reduction of inertia at the endpoint is possible. Nagai *et al.* showed the feasibility of including EEG measurements in the control structure of an RDR robotic system for stroke rehabilitation [14].

However, the role of the design parameters introduced in