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An Example of Collaboration between Medicine and Non-linear Science : Walking Support System based on Non-linear Oscillation Dynamics

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Interpersonal synchronization of body motion has been widely studied as an example of non-linear dynamics. However, it has not been substantially applied to medical engineering system. In this study, by assuming “mutual-entrainment” as an interpersonal synchronization mechanism, we establish a new cooperative walking support system between a walking human and a walking robot. In this system, rhythmic sounds corresponding to the timing of footsteps are exchanged between them on the basis of our previous studies. As a result, it was demonstrated that the two walking rhythms adapt mutually after the start of interaction and stable synchronization is generated automatically. This global synchronized state exhibits dynamic stability with small fluctuation in the walking period. Applying this method to walking rehabilitation for Parkinson's disease and hemiplegia patients, its effectiveness in stabilizing the walking of the patient was shown. These results strongly indicate the importance of collaboration between Medicine and Non-linear Science.