This talk introduces a series of research outcomes on passivity-based estimation and control in networked robotics and vision. The former part discusses how passivity is utilized for visual feedback motion estimation and control. After pointing out inherent passivity in 3-D rigid-body motion, we present a passivity-based 3-D motion estimation mechanism, termed "visual motion observer," and the observer-based camera control scheme. It is also shown that the presented framework can successfully incorporate other passive components like an object motion model and a manipulator dynamics while ensuring stability of the total system, owing to passivity preservation property w.r.t. feedback connections.

The second part investigates passivity-based cooperative control and estimation. We introduce the idea of synchronizing passive dynamical components under local interactions. We then address 3-D motion coordination problems of a network of rigid bodies. The presented results are also extended to flocking in three dimensions, making use of the energy-based property of the passivity approach. Finally, we address visual feedback motion coordination and cooperative motion estimation, combining the ideas of the above two parts.

Takeshi Hatanaka received a B.Eng. degree in informatics and mathematical science, and M.Inf. and Ph.D. degrees in applied mathematics and physics, all from Kyoto University, Japan. He is currently an assistant professor in the Department of Mechanical and Control Engineering, Tokyo Institute of Technology, Japan. His research interests include cooperative control and estimation for robotic networks and visual sensor networks. He received Outstanding Research Award and Best Paper Award from SICE in 2014 and 2009, respectively.