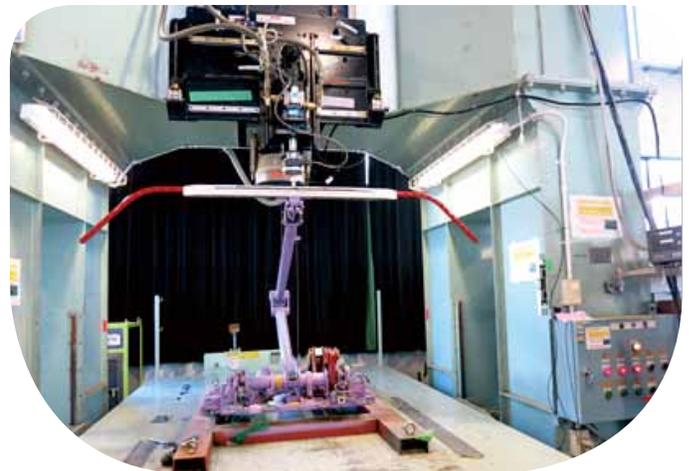


The university of Bristol

Collaborative Research with ACTLab on Pantograph/Catenary Hybrid Simulation

RTRI and Professor David Stoten, head of ACTLab (Advanced Control and Test Laboratory), University of Bristol, UK, conducted collaborative research from April 2016 to March 2018. Bristol is located in south west England and it takes 2 hours from London by the Great Western Railway, originally built by Isambard Kingdom Brunel in 1833. Historically, Bristol is well-known as a trade port and has extensive aerospace, advanced materials, electronic and automotive industries.

In order to evaluate the dynamic interaction of pantograph/catenary systems, RTRI and ACTLab have developed a hybrid simulation that is based upon a physical pantograph and a numerical simulation of the catenary. The hybrid simulation consists of the physical pantograph, a hyWaulic actuator and a real-time simulator. Measured contact forces between the pantograph head and the actuator are used to calculate the motion of the dynamical catenary model, which is constructed in the real-time simulator. In turn, the calculated displacement of the

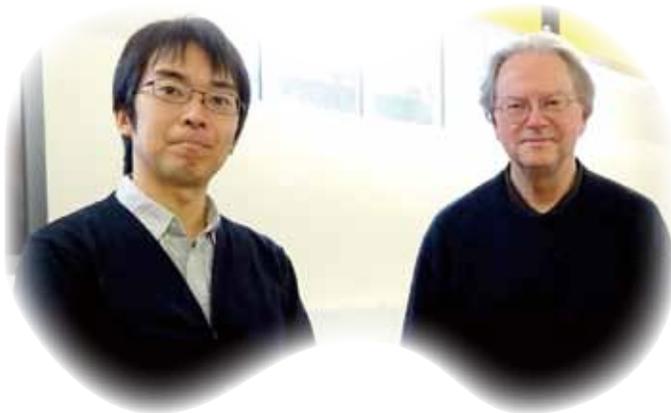


Pantograph test rig at the RTRI

contact wire is used to generate the actuator control signal. Since the dynamic motion of the virtually travelling pantograph can be obtained from the bench test, the hybrid simulation can enable a rapid development of the pantograph. This collaborative research also developed a more stable hybrid simulation for pantograph/catenary, compared with the conventional 'HiLS' technique, by using the dynamically substructured system approach.

The proposed method was validated using a pantograph test rig at the RTRI, where the commonly-used pantograph of high-speed railways in Japan was virtually travelling under the catenary at 300 km/h. The measured displacement of the pantograph head corresponds very closely with that of an accurate simulation.

Our future work will be focused upon further validation of the proposed hybrid simulation method, based upon comparisons with measured data from actual on-track testing.



Dr. Kobayashi

Prof. Stoten

The investigators in the ACTLab

(Shigeyuki Kobayashi, Current Collection)