Proposal of Data Based Preview Controller for Active Vehicle Suspension

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   This paper proposes the new concept of preview controller for active vehicle suspension. In the new concept, unsprung mass state value map is generated by data from positioning system, accelerometer and so on. Then the preview controller is realized with using the generated map and positioning system. The accuracy of unsprung mass displacement estimation and the advantage compared to feed-back control and conventional preview control with online data processing are verified in equations, simulation, bench test and actual driving.

   1) In the new concept, unsprung mass state value map is generated by data from positioning system, accelerometer and so on. Then the preview controller is realized with using the generated map and positioning system (Fig.1).

   2) Theoretical advantage of the controller theoretically compared to other suspension controllers is shown not only in equation but also in simulation.

   3) Procedure for generating unsprung mass displacement map in actual driving and a method of predicting future vehicle path in actual driving are shown (Fig.2).

   4) Accuracy of unsprung mass displacement estimation is validated in actual driving (Fig.3).

   5) Lower motion in ultra-low frequency body motion (below 1Hz) and better secondary ride (around 2-8Hz) compared to conventional suspension controller are validated in test bench and actual driving (Fig.4).
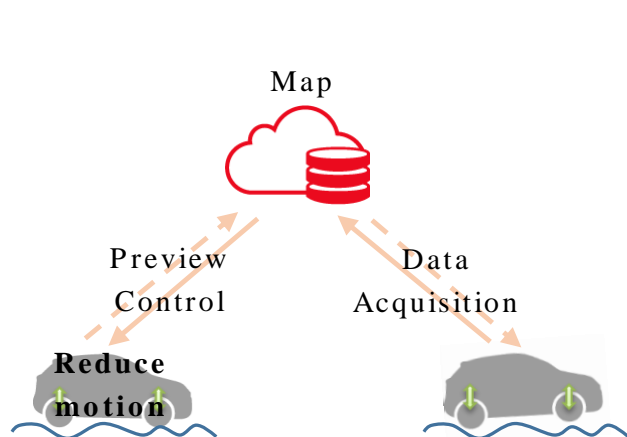

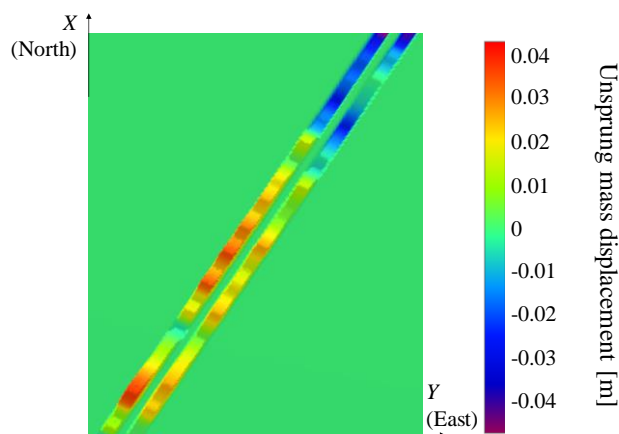Fig.1 Concept of databased preview controller

Fig.2 Contour of generated unsprung mass displacement map
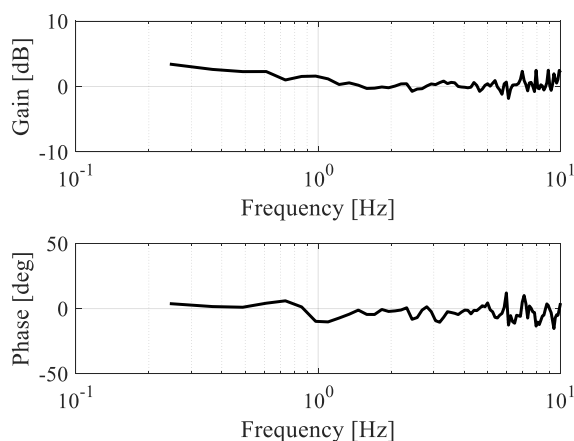

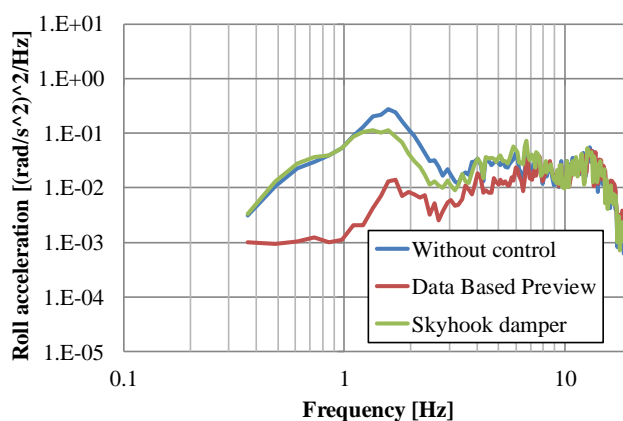Fig.3 Transfer function of actual unsprung mass displacement / estimated unsprung mass displacement in actual driving

Fig.4 PSD of roll acceleration in actual driving