Koki Makita, Mitsuru Murase, Kyoichiro Kondo and Izuru Takewaki, 2018, Robustness evaluation of base-isolation building-connection hybrid controlled building structures considering uncertainties in deep ground, *Frontiers in Built Environment,* 4:16.

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Abstract An evaluation method of robustness of base-isolation building-connection hybrid controlled building structures is developed by introducing a measure for robustness (robustness function) and considering shallow and deep ground uncertainties. The earthquake ground-motion amplitude at the earthquake bedrock is evaluated by the Boores stochastic method including the fault rupture and the wave propagation into the earthquake bedrock. Then, the phase angle property at the earthquake bedrock is investigated by introducing the concept of phase difference, which is defined for each earthquake type. The ground-motion amplification in the shallow and deep ground is expressed by the one-dimensional wave propagation theory. The robustness of base-isolation building-connection hybrid controlled building structures is measured by use of the robustness function due to Ben-Haim (2006) and is evaluated by taking full advantage of the updated-reference-point method. It is shown that, as the total quantity of damping coefficients of connection dampers increases, the robustness for the deformation of the base-isolation story becomes larger without the drastic reduction of the robustness for the top acceleration.

Keywords robustness, base-isolation, building-connection, hybrid control system, uncertain ground property,deep ground, wave propagation, phase difference.