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GENERATION OF ARTIFICIAL WIND AND ESTIMATION OF LOAD FROM STRUCTURAL RESPONSE

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Abstract. *A method of generating artificial wind load is proposed incorporating with the recommendations for statistics of the random wind offered in the architecture community. The method consists of two steps; the first one is to generate the wind velocity from the computer-simulated white noise, and the second is to produce the wind pressure from the wind velocity using the aerodynamic admittance. An inverse problem is further investigated for estimating wind load acting on the building structure from the measurement data which is made on the response of the structure.*
Keywords: Artificial wind, Wind velocity, Wind pressure, Inverse problem, Simulation

1. **Introduction.** In the architectural engineering, there are two major problems; one is how to design high-rise building structures against the wind load, and the other is how to construct the diagnosis system which is called the health-monitoring for checking the damage caused by wind and/or earthquake disturbance loads. The former requires the computer-simulation method at the design stage to investigate dynamic behaviors of the relevant structure, while the later concerns with the identification of structural parameters such as mass, stiffness and damping. This paper concerns with the former problem.

It will be commonly believed that one of important challenges in structural design is the generation of artificial wind and/or earthquake loads. These loads are necessary for computer simulations to show how well the structure withstands vibrations caused by these loads. Especially, for the analysis of random responses of structures such as long-span bridges, high-rise buildings and space structures (which are called flexible structures in control system engineering), one needs, besides the spectral response, the time-history of the seismic waves and/or wind loads. Of course, there are so many recorded data on the real seismic waves and wind velocity or pressure. Needless to say, however, the models to generate such waves or loads artificially are still required to investigate structural responses fully by computer simulations. As for the seismic waves, one of the authors has presented a model based on the chaplet-based signal approximation and the Wigner-Ville distribution, and applied it to reproduce the real seismic waves [1].

In this paper the authors concentrate their attentions to the artificial wind loads. Although the significance of artificial wind has been recognized quite a while, much more in-depth research is necessary before any meaningful engineering design conclusions can