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MODELING OF WIND PROFILE GRATIFYING GIVEN POWER AND CROSS SPECTRA*

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Abstract. *Two methods are proposed for generating the random wind velocity whose power and cross spectral densities are specified to reflect the real world. The one is based on the linear dynamic system with white Gaussian noise processes as the seed of randomness; while the other is derived based on the spectral representation of a stationary process from the Wiener processes defined on the frequency domain. The windward pressures are calculated from the wind velocities through aerodynamic admittance. Sample runs of windward pressure are illustrated by simulation works.*
Keywords: Modeling, Wind profile, Power and cross spectra, Simulation

1. **Introduction.** Wind-excited vibration of tall structures such as high-rise buildings or slender towers may cause fatal structural failure, discomfort to occupants or malfunction of equipment; hence, it is of particular importance to investigate the active and/or passive control problem of such tall structures whose random vibrations are caused by wind- and/or seismic disturbances. In order to research the active/passive control problem in structural design, it is inevitable to generate artificially wind and/or seismic waves. These waves are used to show how well the structure withstands random disturbance loads. Nowadays, the generation of artificial waves is considered as one of distinct technologies. A useful mathematical model for generating seismic waves was proposed by one of the authors using chirp signals and its simulation studies were conducted to test whether the proposed model recovers well or not [1].

Especially, in wind engineering, the analysis seems to have attained maturity to a certain extent [2], [3]. However, despite of such a situation, the white noise process whose spectral density is constant over frequency domain is traditionally employed as a model of wind load, disregarded utterly the fact that the spectral density of the actual wind is not constant. The reason why such stationary white noise is used is based mainly on the fact that the optimal control theory is developed in the linear-quadratic-Gaussian (LQG) framework where the stationary random load is assumed [4], [5]. Needless to say, the

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