1/f Noises as a Superposition of First Order Autoregressive Model TAKAYUKI FUJITA, AKIRA TSUKAMOTO, SHIGERU TADA, National Defense Academy — In various physical and physiological systems, power spectrum densities (PSD) of temporal sequences appear to be inversely proportion to the frequency. Those systems include the fluctuations of resistances in semiconductors, heart beats and membrane currents. Those inverse proportions of PSD to frequency are so called 1/f noises. One of the mechanisms with which 1/f noises are generated is superimposition of Ornstein-Uhlenbeck processes. Although this superimposition of Ornstein-Uhlenbeck processes, sequential temporal sequences, successfully generate 1/f noises, temporal sequences in physical and physiological systems are rarely measured sequentially. Instead, those temporal sequences are usually measured discretely. In this study, 1/f noises were attempted to generate with AR(1) processes, one example of discrete temporal sequences. As a result, PSD of superimposed AR(1) processes was inversely proportion to the frequency under some limitations. Those limitations include uniformly distribution of model parameter for AR(1) processes and white noise of driving noise. Thus, it was suggested that 1/f noises could be generated by superimposing discrete temporal sequences.

Takayuki Fujita
National Defense Academy