MODELING REAL-VALUED CORRELATION FUNCTIONS OF NONSTATIONARY RANDOM SEQUENCES

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The production of modern microelectronic products has no analogues in other industries in terms of strict requirements for the quality of raw materials, working environments, and the accuracy of compliance with regimes. Due to natural fluctuations in the properties of materials and the environment, the parameters of the product and technological processes and the variable states of all technological processes cannot be described by deterministic laws. In most cases, the parameters of technological equipment and its operating modes are random functions of space-time coordinates. To solve complex technological problems, developments in modeling non-stationary random functions using correlation and poly-Gaussian methods can be involved. Consider the correlation function

$$K(n,m)=K_\infty(n-m)+\sum_{\tau=0}^{\infty}W(n+\tau,m+\tau)$$

in the case of asymptotic damping $K_\infty=0$.

Infinitesimal correlation function characterizing the deviation of a non-stationary random sequence from a stationary one $W(n,m)=K(n,m)-K(n+1,m+1)$ where $K(n,m)=\langle \xi_n,\xi_m\rangle_{H_\xi}$, $\xi_n=T^n\xi_0$, ξ_n- non-stationary sequence in Hilbert space H_ξ.

Consider a random sequence generated by a random sequence in $L^2_{[0,1]}$ of the form $\eta_n=T^n\eta_0$, where T self-adjoint bounded operator of the form $Tf(x)=\lambda_0 f(x)+i\int_0^1\varphi(x)\overline{\varphi(x)}f(y)dy$, $\lambda_0=\alpha_0+i\beta_0\neq\overline{\lambda_0}$, $\left(\dim\overline{\operatorname{Im}TL^2_{[0,1]}}=\infty\right)$.

This sequence in a complex Hilbert space generates a real-valued correlation function of the form:

$$K_R(n,m)=r_0^{n+m}\cos(n-m)\varphi_0\left\|\hat f_0(x)\right\|^2+r_1^{n+m}\cos(n-m)\varphi_1\left\|\hat f_1(x)\right\|^2+$$

$$+r_0^{\,n}r_1^{\,m}\left(a\cos(n\varphi_0-m\varphi_1)+b\sin(n\varphi_0-m\varphi_1)\right),\quad r_0=\sqrt{\alpha_0^2+\beta_0^2},\ r_0<1,\ \varphi_0=\operatorname{arctg}\frac{\beta_0}{\alpha_0},$$

$$\hat f_0(x)=f_0(x)-\frac{\alpha_0\varphi(x)}{\gamma},\ \gamma=\int_0^1\varphi(x)\overline{\varphi(x)}dx,\ r_1=\sqrt{\alpha_0^2+(\beta_0+\gamma)^2},\ r_1<1,\ \varphi_0=\operatorname{arctg}\frac{\beta_0+\gamma}{\alpha_0},$$

$$\hat f_1(x)=\frac{\alpha_0\varphi(x)}{\gamma},\ a=\operatorname{Re}\left\langle \hat f_0(x),\hat f_1(x)\right\rangle,\ b=\operatorname{Im}\left\langle \hat f_0(x),\hat f_1(x)\right\rangle.$$