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ON THE BEHAVIOUR OF RCS DYNAMIC SYSTEMS FORECASTING

SERGEY HILKEVICH

Ventspils University College

Inženieru iela 101, LV-3601, Ventspils, Latvija

E-mail: hil@venta.lv

1. Financial markets time series analysis needs good model approximation for time series. This article considers forecasting task for financial time series analysis based on RSC approximation, when time price behaviour is considered as combination of regular (R), chaotic (C) and stochastic (S) parts.

2. Let us consider time series $X_i = X(t_i)$, generated by variable $X(t)$ at $t = t_i$, $t = i\Delta t$, $i = 1, 2, \ldots, n$ in the case, when variable $X(t)$ is the linear combination $X(t) = \alpha R(t) + \beta S(T) + \gamma C(t)$ of regular $R(t)$, stochastic $S(t)$ and chaotic $C(t)$ functions, $\alpha + \beta + \gamma = 1$. Regular functions $R(t)$ are superpositions $R(t) = \Sigma R_j(t)$ of solutions of differential equations of Van der Pole type
$$\frac{d^2 R_j(t)}{dt^2} + (AR_j^2(t) + BR_j(t) + C)\frac{dR_j(t)}{dt} + \omega^2 R_j(t) = 0$$
and describe market oscillations. Chaotic functions $C_k(t)$ are solutions of Lorenz type differential equations with deterministic non-periodic solutions
$$\begin{aligned}\frac{dC_1(t)}{dt} &= \sigma(C_2(t) - C_1(t))\\ \frac{dC_2(t)}{dt} &= rC_1(t) - C_2(t) - C_1(t)C_2(t)\\ \frac{dC_3(t)}{dt} &= -bC_3(t) + C_1(t)C_2(t)\end{aligned}$$
Stochastic functions $S(t)$ are Bernoulli type random processes provided by random numbers generator $rnd(i)$ with given probability distribution $S(t_{i+1}) = (t_i) + rnd(i)$.

3. By direct modeling it is easy to generate RCS time series with a priori given parameters and the first task of RCS systems theory is to restore back those parameters from time series a posteriori. In the case when this task can be solved, it is possible to solve task of RCS system behaviour forecasting, extrapolating solutions with known parameters.

4. At present time there are good estimations of upper noise level, when it is still possible to recognize signal, received by different groups for RS and CS systems, but at present time there are no estimations for RSC systems. This article contains the first attempt to make upper noise level for RCS system.

5. Two main methods were used to estimate RCS systems upper noise level - linear regression and Lyapunov's theory. It was shown, that in both cases the upper level of noise for signal recognition is about 5%, which is less, than for RS (20%) and CS (12%) systems.