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# THE FEATURES OF FUNCTIONING OF THE COMMUNICATION CHANNEL WHILE MANAGING AN UNMANNED AERIAL VEHICLE

**Olga Kucheryava**
Ph.D. (Physics and Maths), docent
*National Aviation University, Ukraine*

**Nataiia Holeho**
senior lecturer
*National Aviation University, Ukraine*

**Larysa Bachynska**
senior lecturer
*National University of Kyiv-Mohyla Academy, Ukraine*

Managing an unmanned aerial vehicle (UMAV) can be performed with onboard software devices, only in some cases it has to be performed by the controller (outside pilot) remotely. Besides, unmanned aerial vehicle can be used to carry out many tasks which naturally can not be carried out autonomously, so they require a permanently working communication channel between an unmanned aerial vehicle and terrestrial control centre. In such tasks the route of UMAV moving is not possible to plan before it starts moving [1].

In such a case the necessity to mutually exchange the information in real time arises: the signals of managing the flight and managing signals for devices from the terrestrial control centre to the UMAV have to be sent and the information flow from onboard devices, e.g., from camcorders, have to be sent from UMAV to the land.

If there are a few information sources on the UMAV, e.g., aerial UMAV equipment controller and several camcorders, the flow of complex structure requests, each of which needs individual service, comes into the input of the wireless data channel [2].

Thus, the researching of UMAV communication channels as queuing systems with complex structure requests is offered.

Overlapping different signals in time that may occur in the process of functioning of onboard information systems leads to the necessity of solving the problem of defining of such an intensity of complex structure request flow which would not cause information data loss, and to the tasks on allowable or optimal (considering the opportunities of data channel) level of UMAV onboard device information activity, e.g., about such an operation intensity on object location detecting, which would not cause the loss of this information.

In such a case, the following service system might be considered: request flow—UMAV signals, service channel—satellite receiver.

The request in this case consists of two "impulses"—the one which is being sent by the satellite and the one which reflects from UMAV. In other words, it is as if the unmanned aerial vehicle creates two impulses. The task is being complicated if to take into consideration potential obstacles while data transferring. In the situations being described, much information about UMAV location might be lost, therefore making the process of managing the aerial vehicle more complicated.

Consider the system with an input flow of dual requests, i.e., those where every request of input flow consists of two impulses. Let us define the concept about complex impulses and shear measure of the intersection of two impulses.

A complex impulse is meant to be a random function U= u(t) where

$$u(t) = \begin{cases} 1, \text{ impulse existing at the moment } t, \\ 0, \text{ at the opposite moment.} \end{cases}$$

Let us consider another impulse $V = v(t)$ and mark $UV = (u(t)v(t))$.

Name $V_\tau = (v(t-\tau))$, $\tau \geq 0$ as impulse offset $V$. Then $UV_\tau = (u(t)v(t-\tau))$ (e.g., $(UV_\tau)(\tau) = u(\tau)v(o)$ and let us name $\tau$ as offset $V$ relative to $U$.

May $f(t)$ be probability density of random variable $X$.

Define $UV_X$ as the intersection at random shear for time duration $X$ of the impulse $V$ relatively to $U$; $UV_X = (u(t)v(t-X))$.

This definition is correct if there is a general random variable $\varsigma$ and density $f_\varsigma(x) = 1$, $0 < x < \infty$. It is not a random variable in the common sense, as $\int_0^\infty f_\varsigma(x)dx = \infty$.

Name the functional set $\mu_X = \mu_X(A) = \mu_X(UV_X; A)$ as a shear measurement $\mu_X$ of intersection of complex impulses $U$ and $V$ which is equal to Lebesgue measure of a set of points $t$, a set $A$ where $u(t)v(t-X) = 1$.

For fixed implementation of a random variable $X$, the function $\mu_X(A)$, where $\mu_X(A) \leq L(A)$, where $L(A)$ is a Lebesgue measure of a set $A$.

For sets $A$ and $B$, which do not cross, the equality

$$\mu_X(A \cup B) = \mu_X(A) + \mu_X(B),$$

will be used, where $\mu_X(A)$ is a random measure if $X$ is a random variable.

Based on the formulated and proven theorems for calculating measurements of the intersection of two complex impulses [3], algorithms for the case with limiting the area of determination of the shear measure by denotations R+ have been developed and the evaluation of probability for intersection two impulses to intersect each other has been received. Due to the method of statistic modelling, calculations for probability-temporal characteristics of the mass service system with dual requests have been received and compared with the results of analytical modelling. These calculations give the opportunity to determine the probability of information loss while overlapping complex signals in time during the process of managing UMAV.

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