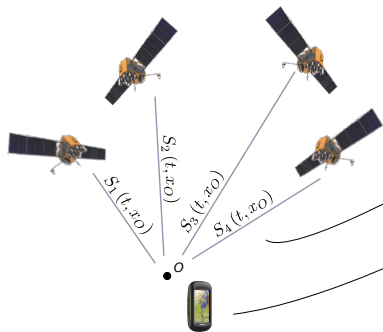


# Universal ranging code generator of GLONASS and GPS open navigation signals

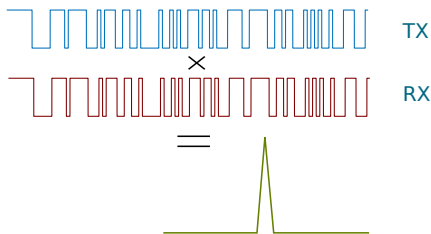
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Moscow Power Engineering Institute

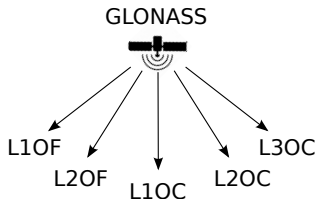
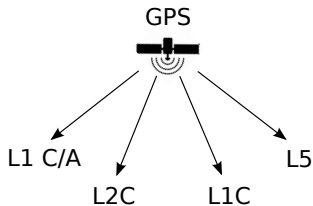
Moscow, March, 2020



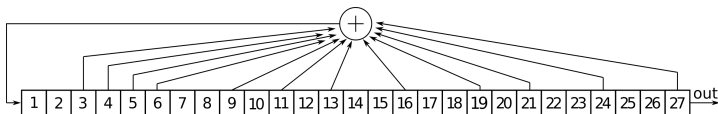
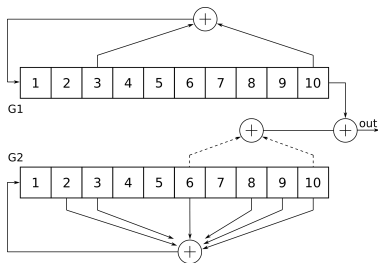
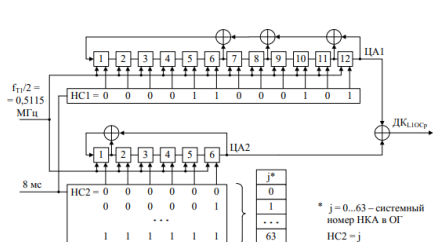
Ranging codes convergence:



Multiple signal types, multiple codes:

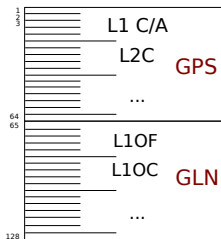


- Generation via linear-feedback shift register (LFSR)
- Generation of ranging codes as hash functions
- Look-up tables codes

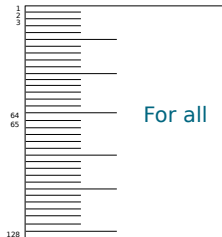


# Proposed structure of the universal ranging code generator

## Specialized channels



## Universal channels



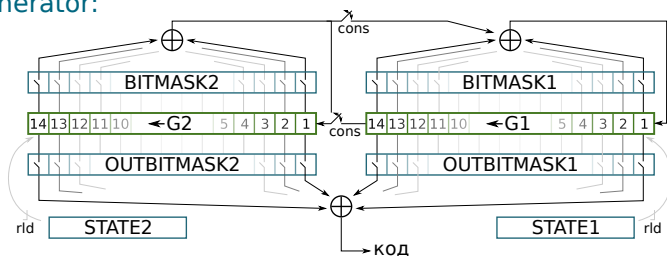
How?



Advantages:

- flexibility
- maintenance
- extension

We need a universal code generator:



Сигнал	bitmask1	bitmask2	outbitmask1
LxOF	00000100010000	-	00000001000000
L1OCd	00001001000000	00001101000100	00001000000000
L1OCp	00110010100000	00000000100001	00100000000000
L2OCp	11000010001000	00000001100000	10000000000000
L3OCx	11000010001000	00000001100000	10000000000000
Summary	11111111111000	00001101100101	10101001000000

Сигнал	outbitmask2	state1	state2
LxOF	-	00000111111111	-
L1OCd	00001000000000	00000001001100	{00001111110000}
L1OCp	00000000100000	00101000110000	{00000000111111}
L2OCp	00000001000000	00011100101100	{00000001111111}
L3OCd	00000001000000	00011100101100	{00000001111110}
L3OCp	00000001000000	00011100101100	{00000001111111}
Summary	00001001100000	00111111111111	{00001111111111}

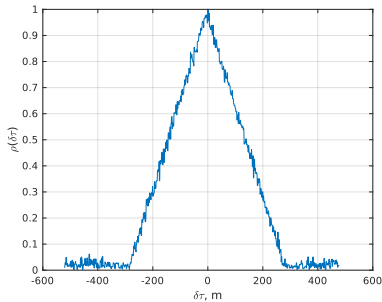
Сигнал	bitmask1	bitmask2	out bitmask1
C/A	00001000000100	00001110100110	00001000000000
L2C CM	01001001010010	01010100111100	01000000000000
L2C CL	01001001010010	01010100111100	01000000000000
L5 I	01101100000000	01100011101101	01000000000000
Summary	01101101010110	01111111111111	01001000000000

Сигнал	out bitmask2	state1	state2
C/A	{00001111111111}	00001111111111	00001111111111
L2C CM	00000000000000	{01111111111111}	{11111111111111}
L2C CL	00000000000000	{01111111111111}	{11111111111111}
L5 I	01000000000000	01111111111111	{01111111111111}
Summary	{01001111111111}	{01111111111111}	{11111111111111}

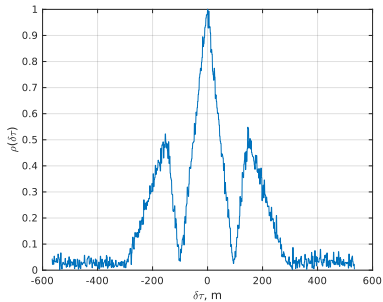
# Correlation functions of the GNSS signals



GLONASS L1OCd, BPSK(1)



GLONASS L1OCp, BOC(1,1)



System	Open signals	Signals with LFSR-based generator	Possible to generate	Unable to generate
GLONASS	7	7	7	0
GPS	9	7	5	4
Summary	16	14	12	4



- The proposed algorithm allows to generate ranging codes for almost **75%** of all open navigation signals systems GLONASS, GPS
- Initialization parameters of the universal ranging code generator for signals: Gln L1OF, GlnL2OF, Gln L1OCd, Gln L1OCp, Gln L3OCd, Gln L3OCp, GPS C/A, GPS L2 CM, GPS L2 CL, GPS L5 I, GPS L5 Q are given
- Recommendations for further optimization of the universal generator are formulated

Thank you for your attention!

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