

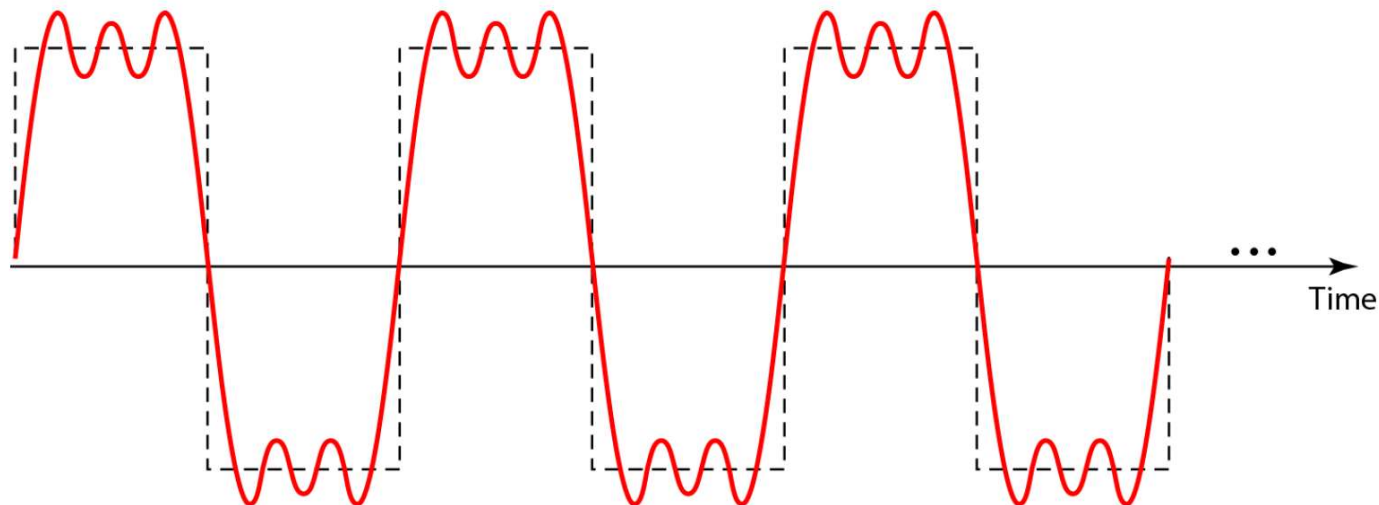
Karakteristike i prenos signala

Prema Furijeovoj analizi, svaki složeni (kompozitni) signal je kombinacija osnovnih harmonijskih signala (sinusnih talasa) sa različitim frekvencijama, amplitudama i fazama.

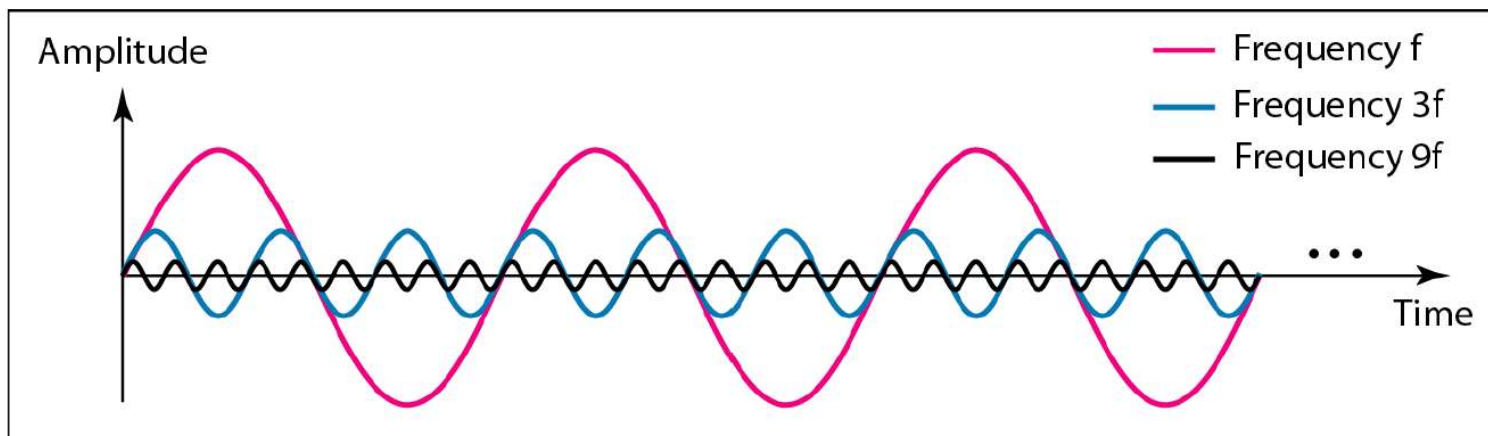
Ako je kompozitni signal periodičan, dekompozicija daje niz signala sa diskretnim frekvencijama.

Ako je kompozitni signal neperiodičan, dekompozicija daje kombinaciju sinusnih talasa sa kontinuiranim frekvencijama.

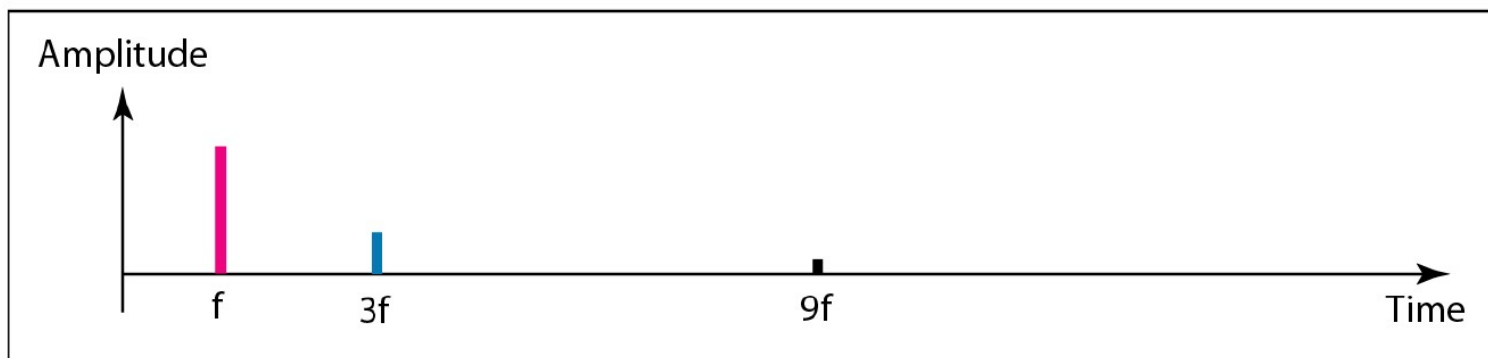
Na slici je predstavljen periodični kompozitni signal koji se zapravo sastoji od tri osnovna harmonijska signala različitih amplituda i frekvencija.



Karakteristike i prenos signala



a. Time-domain decomposition of a composite signal



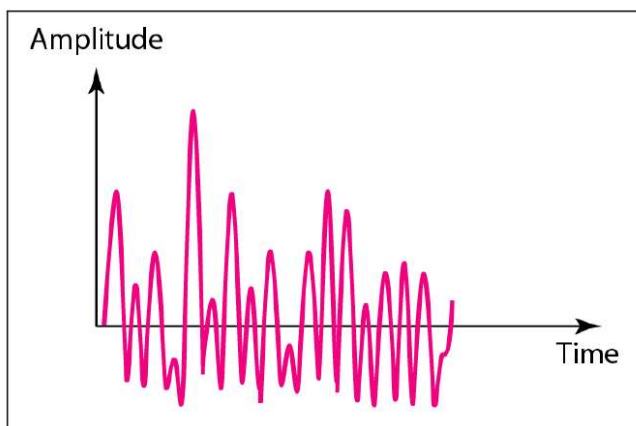
b. Frequency-domain decomposition of the composite signal

Karakteristike i prenos signala

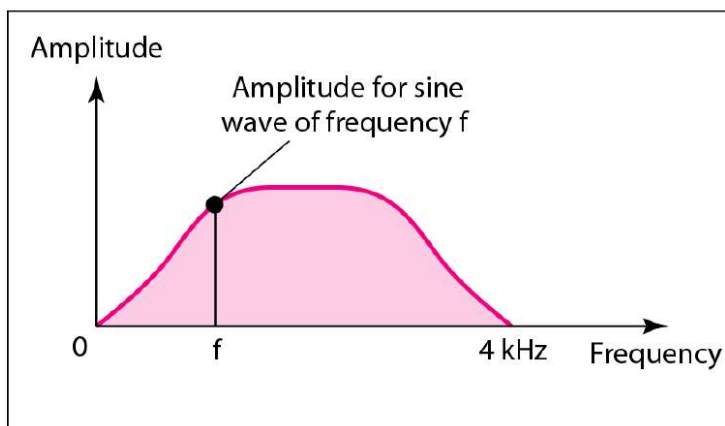
Širina opsega (propusni opseg) kompozitnog signala je razlika između najviše i najniže frekvencije sadržane u tom signalu

Slika prikazuje neperiodični kompozitni signal. To može biti signal koji stvara mikrofoni ili telefonski aparat kada se izgovori reč ili dve. U ovom slučaju, kompozitni signal ne može biti periodičan, jer to implicira da ponavljamo istu reč ili reči sa potpuno istim tonom.

Može se uočiti da je širina opsega prikazanog signala jednaka 4kHz.



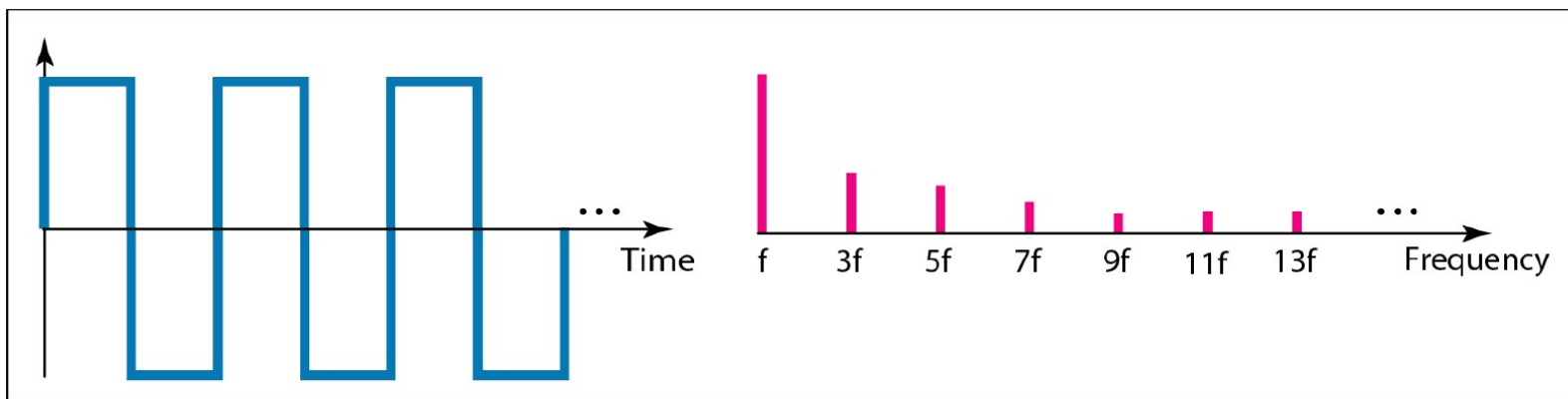
a. Time domain



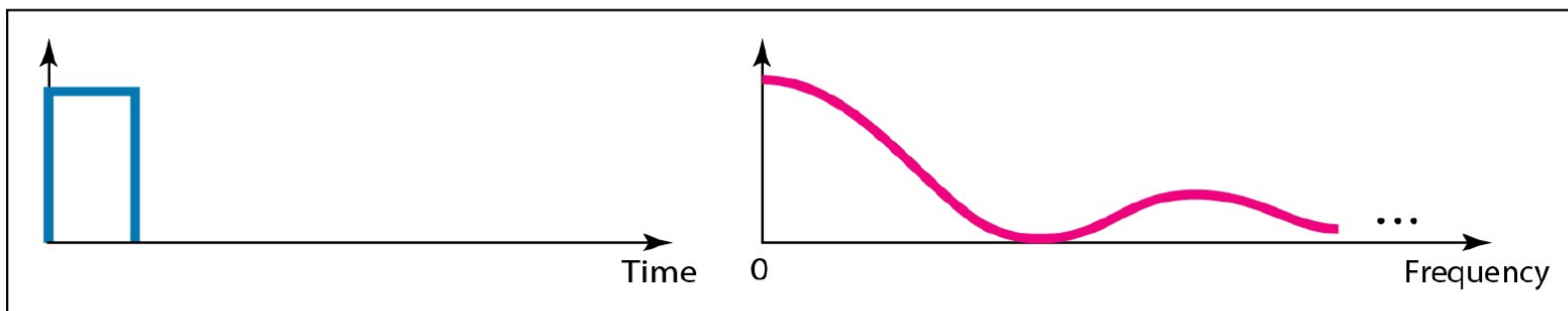
b. Frequency domain

Karakteristike i prenos signala

Digitalni signal je kompozitni analogni signal sa beskonačnim propusnim opsegom.



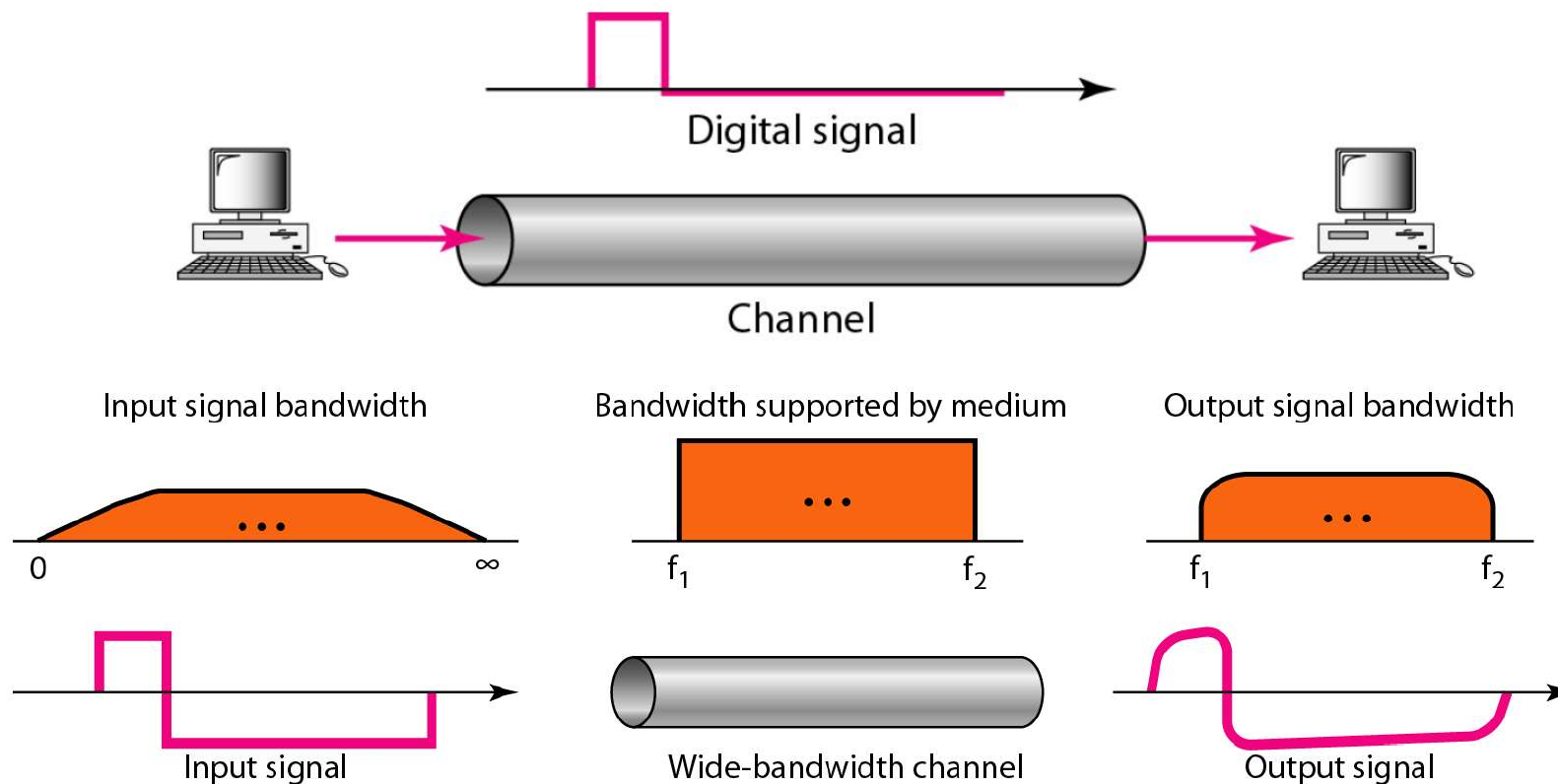
a. Time and frequency domains of periodic digital signal



b. Time and frequency domains of nonperiodic digital signal

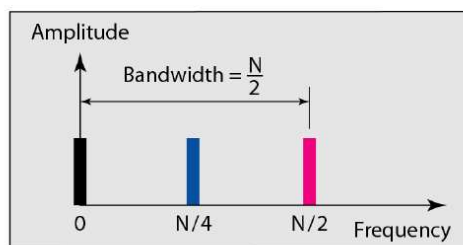
Karakteristike i prenos signala

Prenos u osnovnom opsegu digitalnog signala koji čuva oblik digitalnog signala moguć je samo ako imamo niskopropusni kanal sa beskonačnim ili veoma širokim propusnim opsegom.

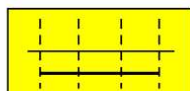
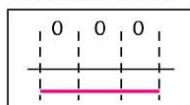


Karakteristike i prenos signala

Gruba aproksimacija digitalnog signala korišćenjem prvog harmonika - najgori slučaj (N - bitska brzina (bit rate), $f_{min} = 0$, $f_{max} = N/2$, $B = N/2$)

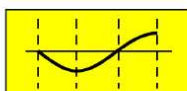
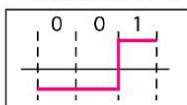


Digital: bit rate N



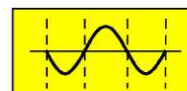
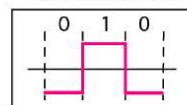
Analog: $f = 0$, $p = 180$

Digital: bit rate N



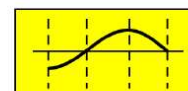
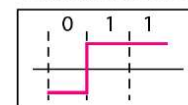
Analog: $f = N/4$, $p = 180$

Digital: bit rate N



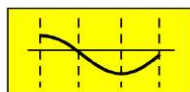
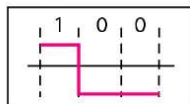
Analog: $f = N/2$, $p = 180$

Digital: bit rate N



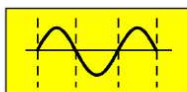
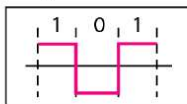
Analog: $f = N/4$, $p = 270$

Digital: bit rate N



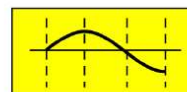
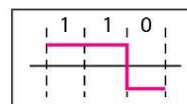
Analog: $f = N/4$, $p = 90$

Digital: bit rate N



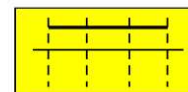
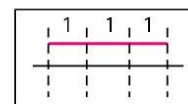
Analog: $f = N/2$, $p = 0$

Digital: bit rate N



Analog: $f = N/4$, $p = 0$

Digital: bit rate N

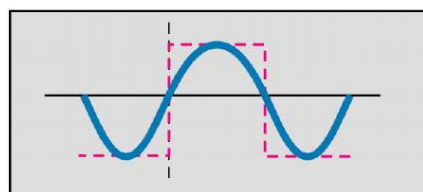
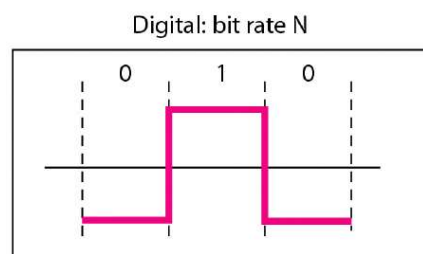
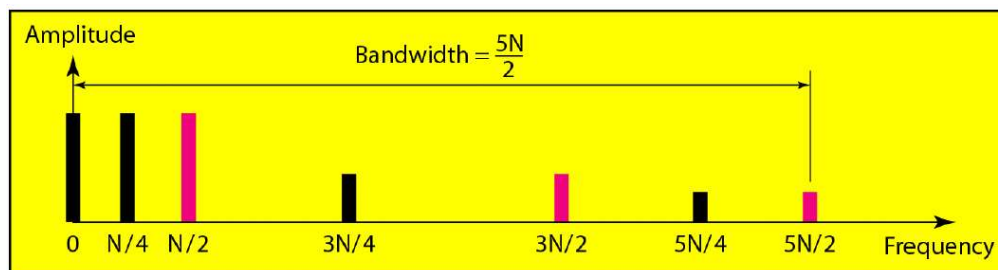


Analog: $f = 0$, $p = 0$

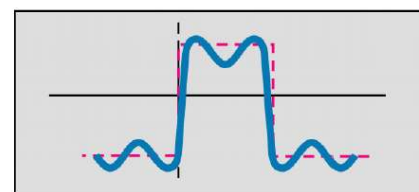
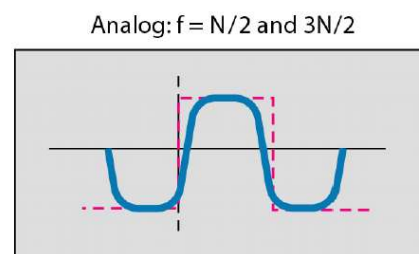
Karakteristike i prenos signala

Gruba aproksimacija digitalnog signala korišćenjem prva tri harmonika (N - bitska brzina (bit rate), $f_{\min} = 0$, $f_{\max} = 5N/2$, $B = 5N/2$).

Pri prenosu u osnovnom opsegu, zahtevani propusni opseg je proporcionalan brzini prenosa; ako treba da šaljemo sa većom bitskom brzinom, treba nam više propusnog opsega. Takođe za bolje očuvanje oblika signala potreban je veći propusni opseg.



Analog: $f = N/2$



Analog: $f = N/2, 3N/2, \text{ and } 5N/2$

Karakteristike i prenos signala

Primer 1

Ako se periodični signal sastoji od pet sinusnih talasa sa frekvencijama od 100, 300, 500, 700 i 900 Hz, koliki je njegov propusni opseg? Nacrtajte spektar, pod pretpostavkom da sve komponente imaju maksimalnu amplitudu od 10 V.

Rešenje

Neka je f_h najveća frekvencija, f_l najniža frekvencija, a B propusni opseg. Onda

$$B = f_h - f_l = 800 \text{ Hz}$$

Spektar ima samo pet šiljaka, na 100, 300, 500, 700, i 900 Hz

