

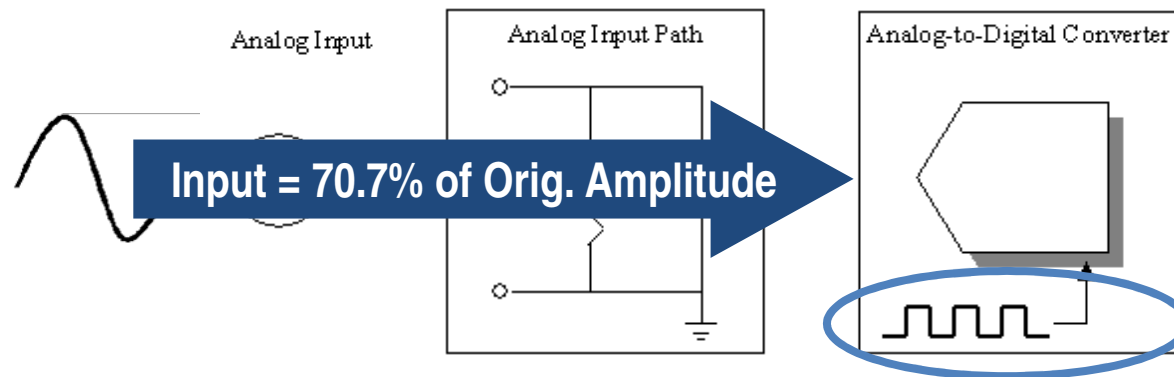
### 6.1. Sisteme de conversie A/D

#### 6.1.1. Notiuni fundamentale – banda, rata de esantionare si criteriul Nyquist

**Banda** = frecventa pentru care un semnal sinusoidal care parcurge calea analogica de intrare este atenuat la 70.7% din amplitudinea originala (frecventa la 3dB).

**Rata de esantionare** = viteza de conversie ADC exprimata in esantioane pe secunda (S/s).

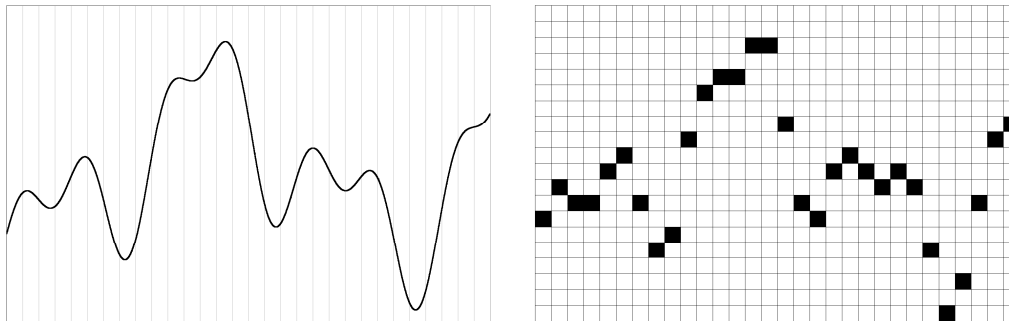
**Criteriul Nyquist** = rata de esantionare = 2 x frecventa maxima a semnalului de intrare.



### 6.1. Sisteme de conversie A/D

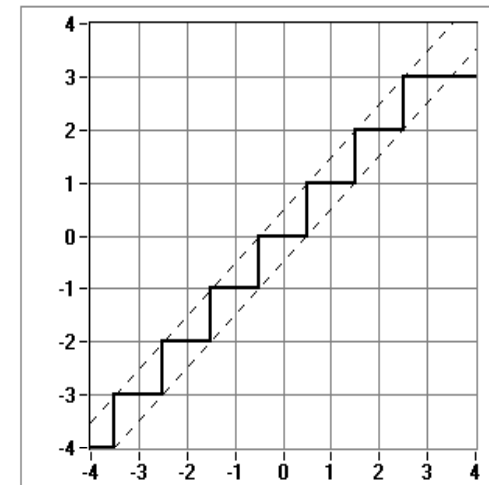
#### 6.1.1. Notiuni fundamentale - esantionarea si cuantizarea

**Esantionarea** = reduce setul infinit de valori de timp la un set finit.

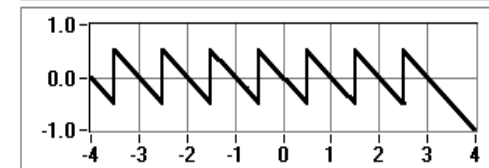


**Cuantizarea** = reduce setul infinit de valori de amplitudine la un set finit.

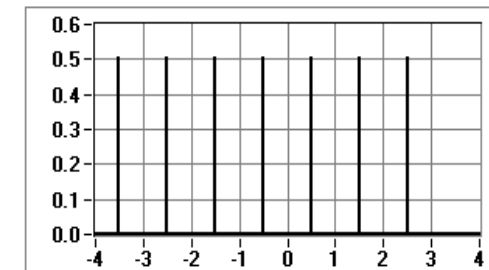
Discrete  
output  
levels



Error



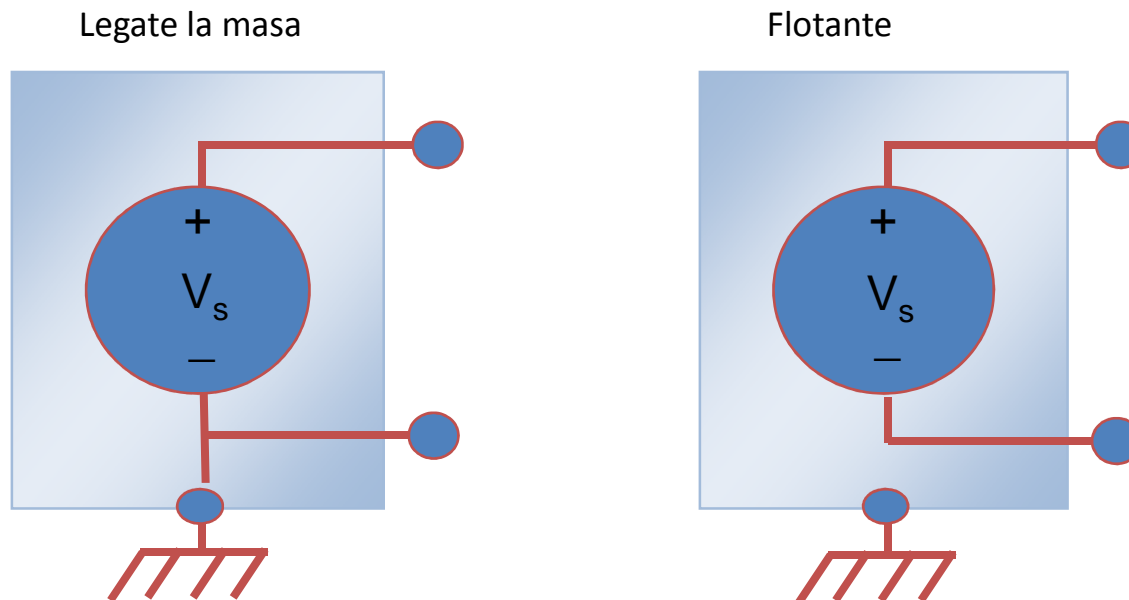
Standard  
deviation



### 6.1. Sisteme de conversie A/D

#### 6.1.1. Notiuni fundamentale – topologii de masura

**Surse de semnal:** flotante sau referentiate fata de masa.

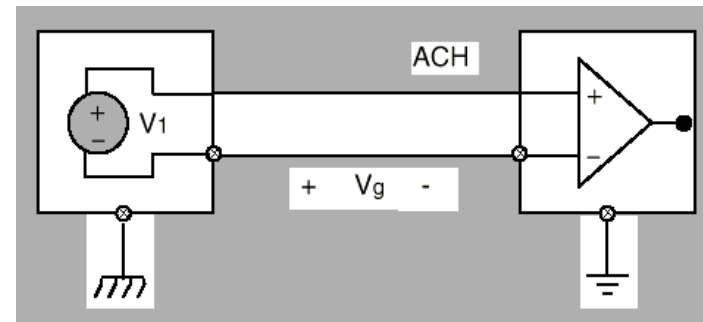


### 6.1. Sisteme de conversie A/D

#### 6.1.1. Notiuni fundamentale – topologii de masura

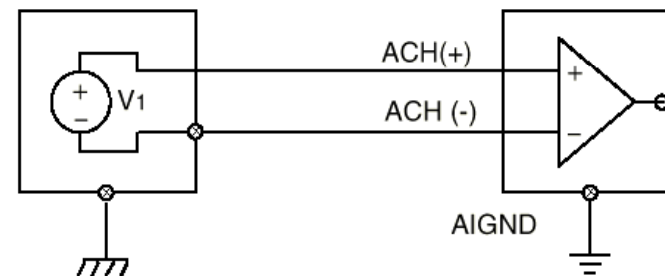
##### Unipolare

- +Simplitate
- Pot genera bucle de masa daca  $V_1$  nu e flotant
- Dispozitivele pot fi deteriorate de descarcari (rare)



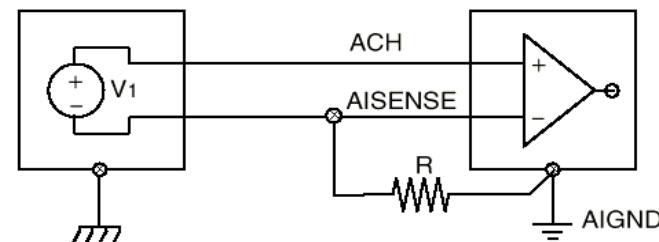
##### Diferentiale

- + Bune daca  $V_1$  este impamantata
- + rejecteaza semnalele de mod comun
- Domeniu de mod comun finit.



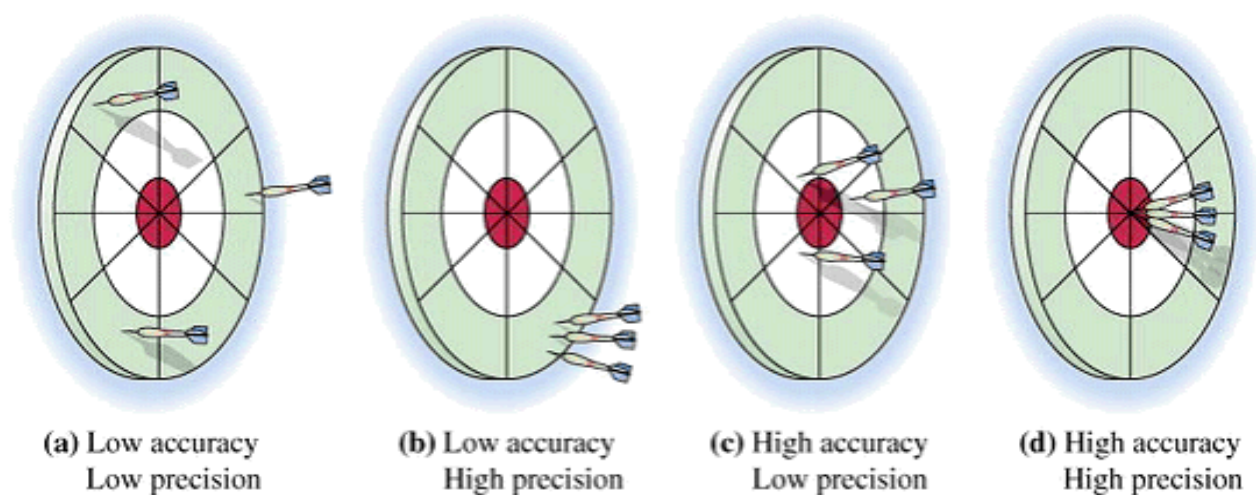
##### Pseudo-Diferentiale

- + Rejectie de mod comun buna
- + Intrerup buclele de masa
- Izolatie redusa



### 6.1. Sisteme de conversie A/D

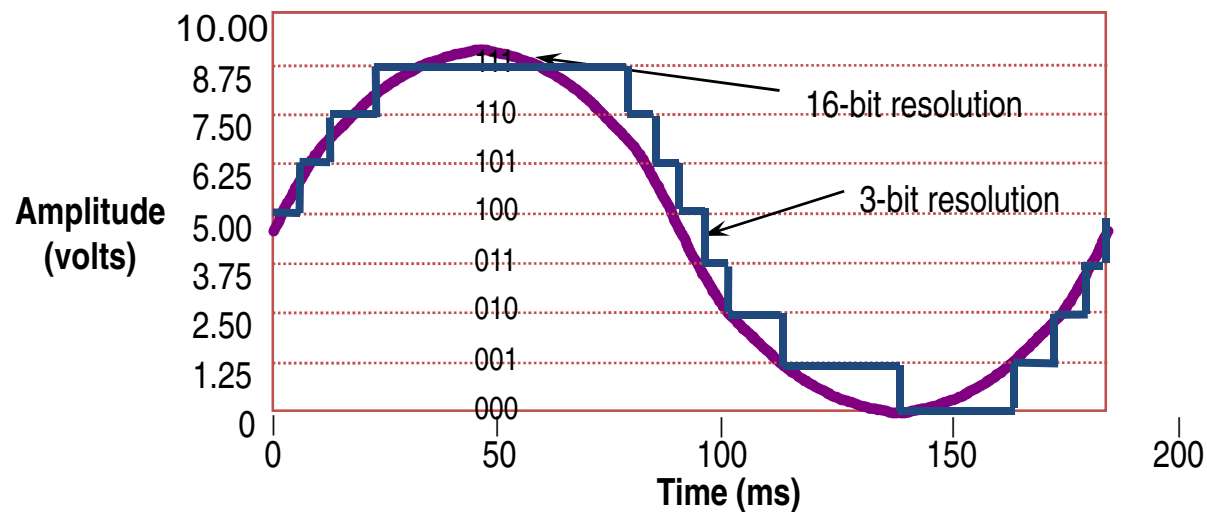
#### 6.1.1. Notiuni fundamentale – acuratete, precizie (rezolutie), senzitivitate



### 6.1. Sisteme de conversie A/D

#### 6.1.1. Notiuni fundamentale – acuratete, precizie (rezolutie), senzitivitate

**Rezolutie** – numarul de biti utilizati pentru reprezentarea semnalelor. Rezolutie mai mare => precizie mai mare.



**Senzitivitate** – cel mai mic semnal detectabil de un instrument.

**Acuratete** – nivelul de incertitudine al unui instrument la masurarea unei marimi.

### 6.1. Sisteme de conversie A/D

#### 6.1.2. Tipuri de ADC

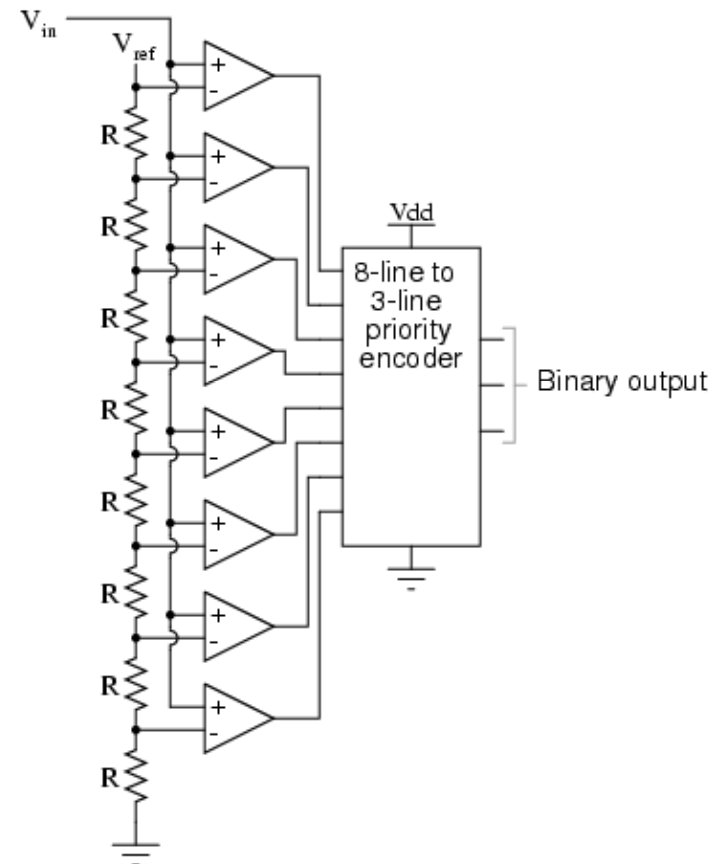
##### Flash and Pipeline Flash - High-Speed Digitizers -

denumite si ADC paralele:

sunt compuse dintr-o serie de comparatoare a  
caror iesire este conectata intr-un encoder care  
genereaza o iesire digitala.

Avantaje: viteza foarte mare a conversiei.

Dezavantaje: necesita multe componente; de  
exemplu, pentru un convertor ADC de 3 biti sunt  
necesare 8 comparatoare, pentru unul de 8 biti  
sunt necesare 256 comparatoare.



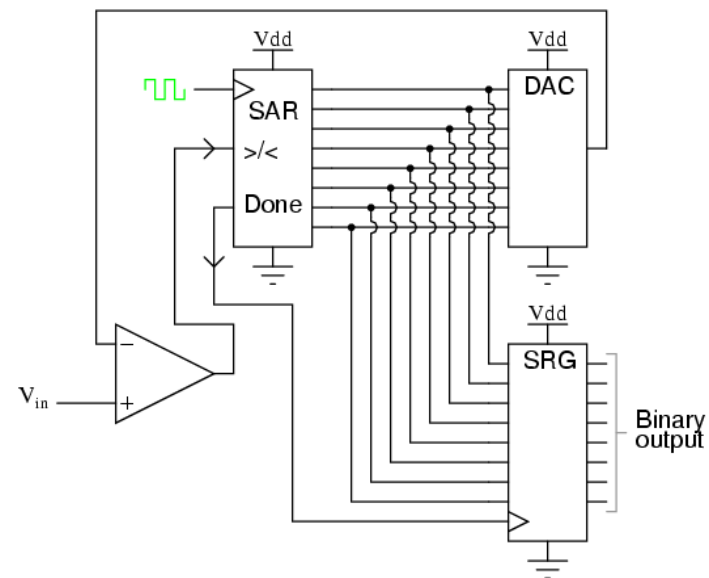
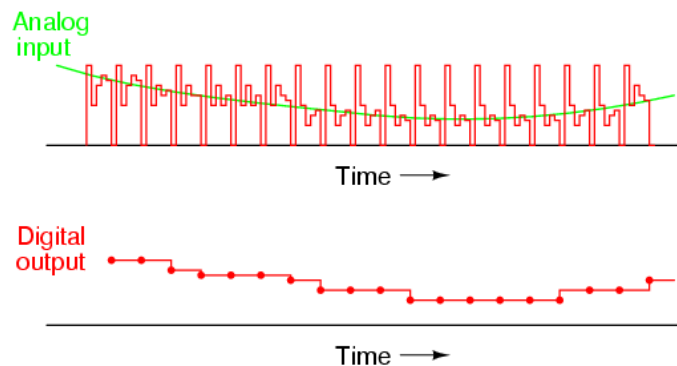
### 6.1. Sisteme de conversie A/D

#### 6.1.2. Tipuri de ADC

##### SAR

Convertoare cu registru de aproximari succesive: un registru numarator va cuantifica valorile comparatiilor dintre marimea analogica generata de DAC si marimea de intrare prin metoda injumatatirii intervalului.

Viteza de conversie: pana la 3MS/s, rezolutie pana la 18 biti.



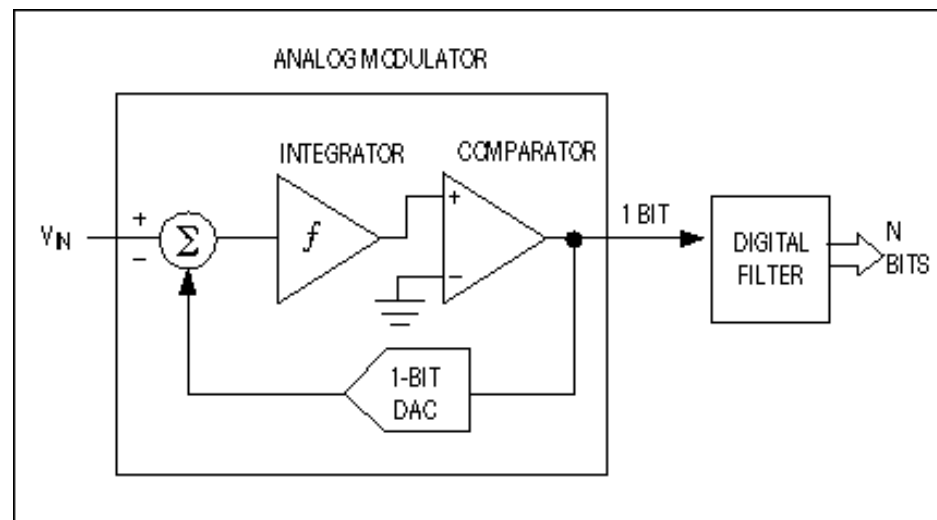


### 6.1. Sisteme de conversie A/D

#### 6.1.2. Tipuri de ADC

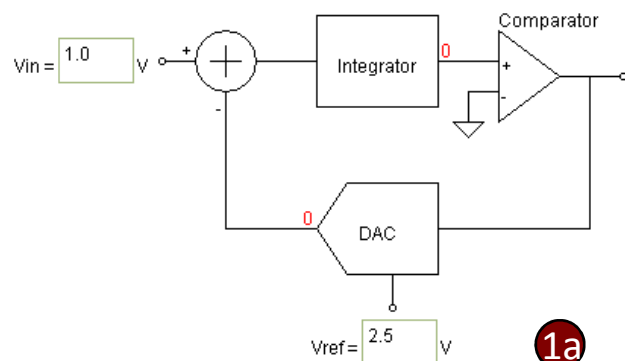
##### Delta-Sigma

Este un convertor de tip integrator, din filtrul digital se va obtine valoarea conversiei. (exemplu de functionare).

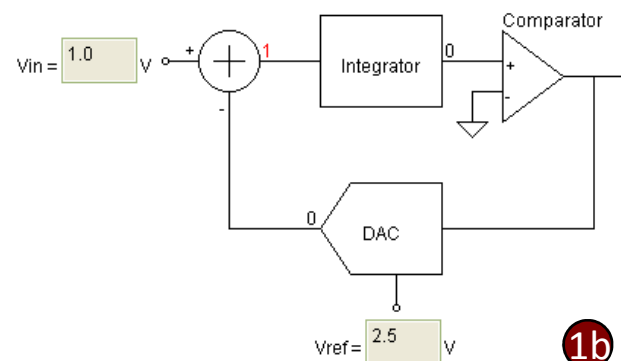


### 6.1. Sisteme de conversie A/D

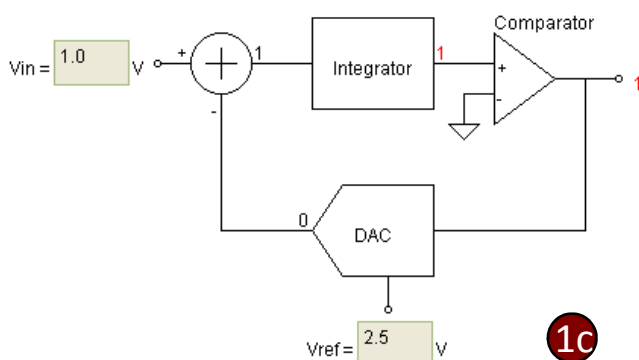
#### 6.1.2. Tipuri de ADC – convertorul Delta-Sigma – exemplu de functionare



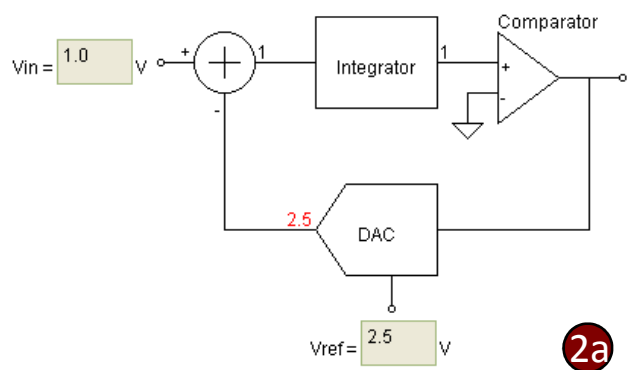
Bitstream:  
Mean output:



Bitstream:  
Mean output:



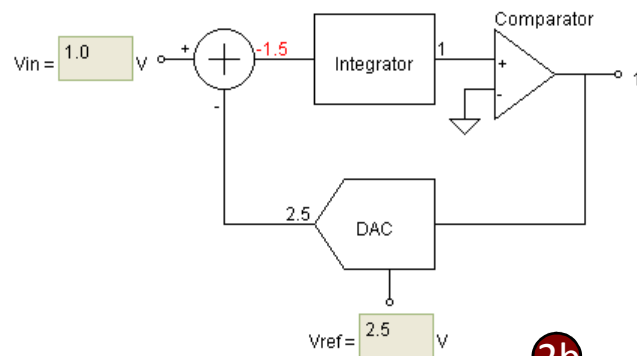
Bitstream: 1  
Mean output: 2.5V



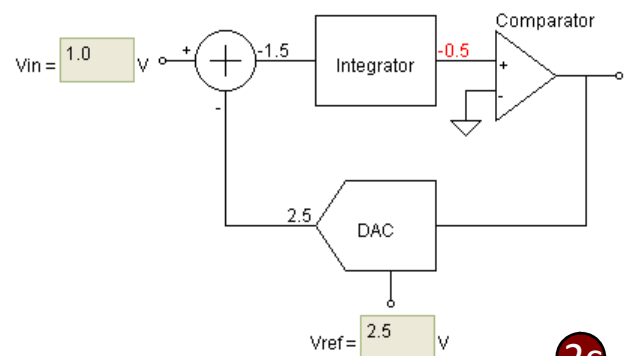
Bitstream: 1  
Mean output: 2.5V

### 6.1. Sisteme de conversie A/D

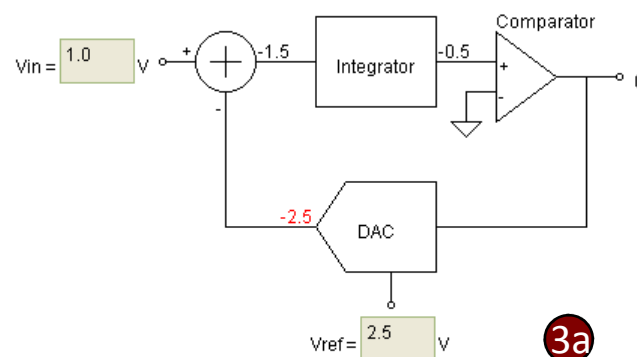
#### 6.1.2. Tipuri de ADC – convertorul Delta-Sigma – exemplu de functionare



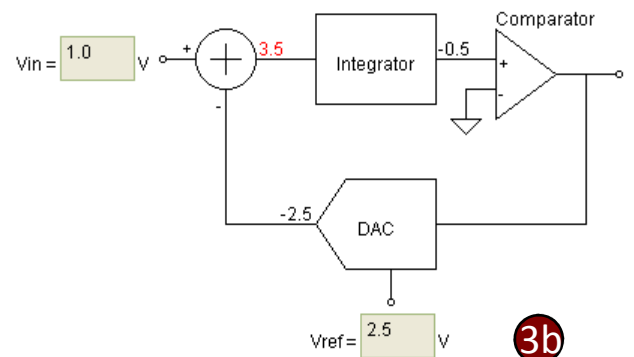
Bitstream: 1  
Mean output:  $2.5\text{V}$



Bitstream: 1 0  
Mean output:  $0\text{V}$



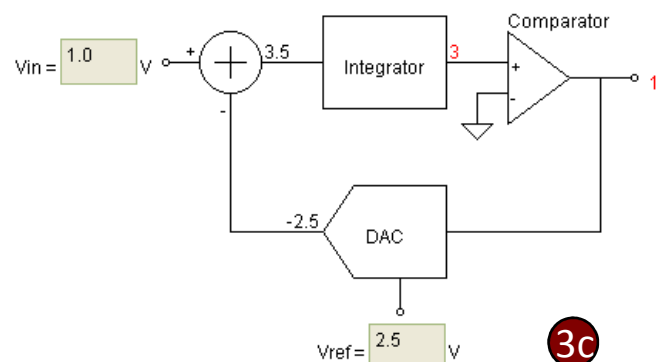
Bitstream: 1 0  
Mean output:  $0\text{V}$



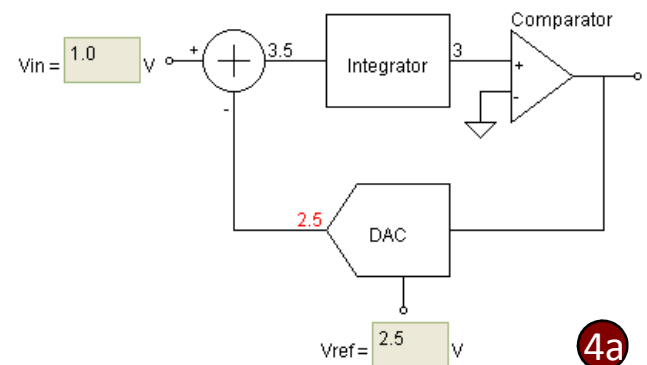
Bitstream: 1 0  
Mean output:  $0\text{V}$

### 6.1. Sisteme de conversie A/D

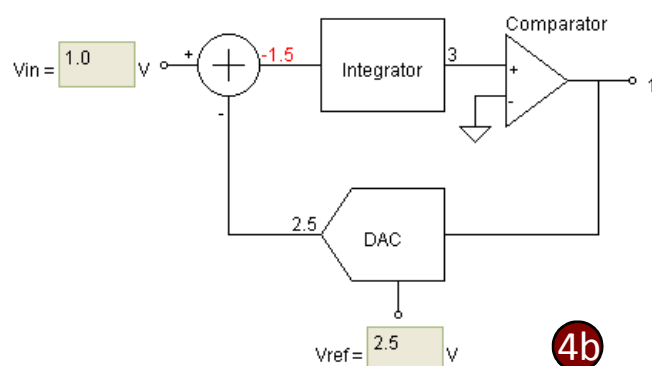
#### 6.1.2. Tipuri de ADC – convertorul Delta-Sigma – exemplu de functionare



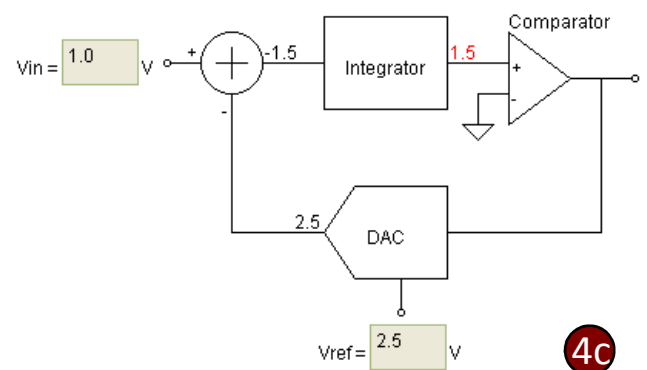
Bitstream: 1 0 1  
Mean output: 0.83V



Bitstream: 1 0 1  
Mean output: 0.83V



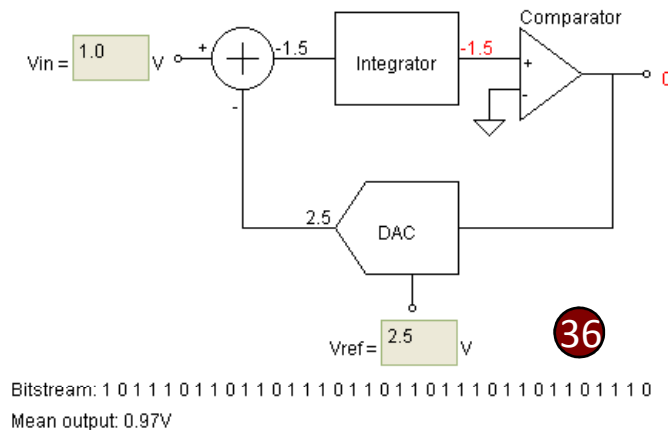
Bitstream: 1 0 1  
Mean output: 0.83V



Bitstream: 1 0 1 1  
Mean output: 1.25V

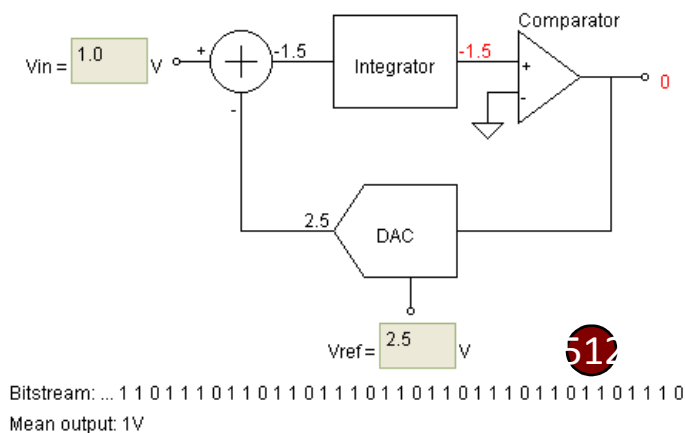
### 6.1. Sisteme de conversie A/D

#### 6.1.2. Tipuri de ADC – convertorul Delta-Sigma – exemplu de functionare



Dupa 512 iteratii se va obtine un sir de date (0,1) pentru care vom avea app. 70% valori de 1 si app.30% valori de zero.

Considerand  $V_{fs} = 5V$  (intre  $-2.5$  si  $+2.5$ ) avem ca 70% din  $5V = 3.5V$ . Scaland aceasta fata de  $-2.5V$  obtinem ca 70% din intervalul  $(-2.5, +2.5)$  este  $1V$ .



Cu cat se maresc numarul de integrari, convertorul poate sa devina instabil.  
Avantaje: rezolutie si liniaritate mare.  
Dezavantaj: oversampling.

Se poate imbunatati intercaland un flash ADC la iesirea integratorului pentru a comanda un multibit DAC.