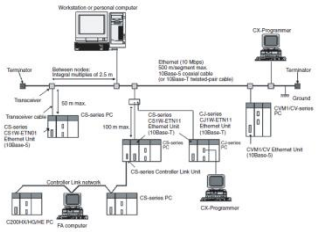
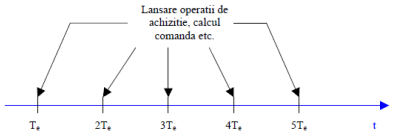
SCADA, HIL, SIL - SHS

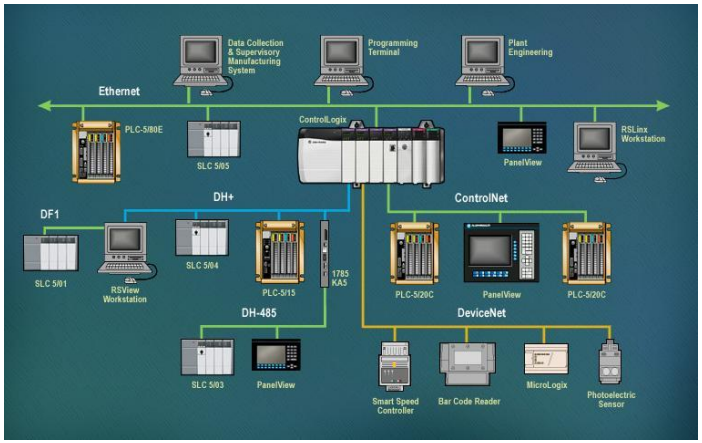
C10: Tendinte in proiectarea si implementarea sistemelor SCADA

Cuprins:

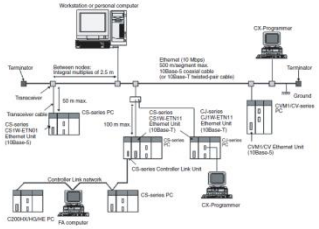
- Introducere
- Tendinte hardware
- Tendinte software
- Tendinte algoritmi
- Exemple







C10: Tendinte

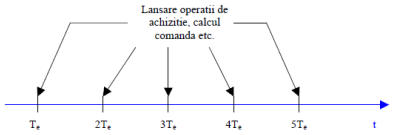


1. Introducere

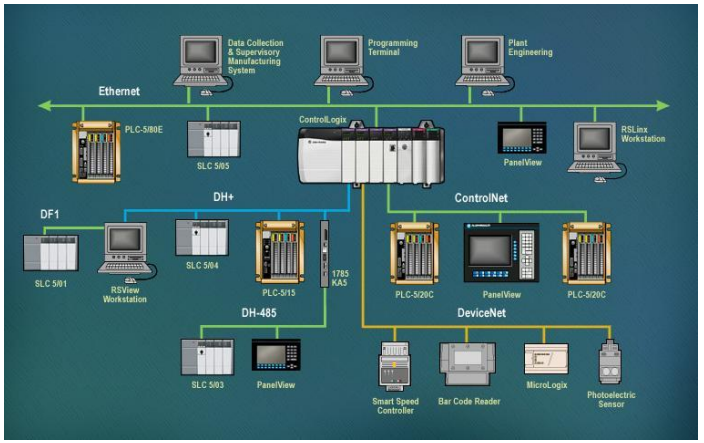
Concepte – existente - SCADA

(Sistemelor de masurare si control – sisteme SCADA)

SCADA – Supervisory Control and Data Acquisition



- Functionare in Timp Real (RT)
- Modularitate
- Repetabilitate
- Interconectare - standardizare
- Portabilitate - Migrare
- Siguranta



Tendinta generala - optimizare

C10: Tendinte

2. Tendinte Hardware

- **Tendinte de acoperire a tuturor “niselor”**
  - Modularizare maxima;
  - All in one;
  - Putere de calcul (foarte mare);
  - Utilizarea sistemelor de comunicatie moderne;
  - PAC.

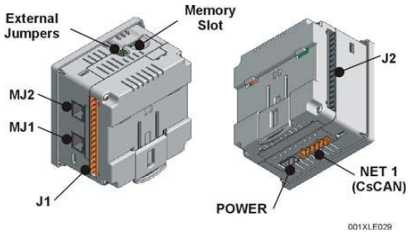
C10: Tendinte

2. Tendinte Hardware

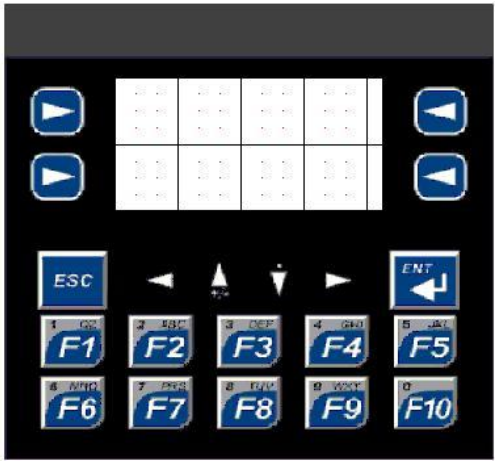
- Modularizare maxima
  - Structurile AP contin elemente foarte variate
  - Modulul procesor este “singur”
  - Existenta unor sasiuri sau magistrale interne
  - => necesita platforme software complexe

C10: Tendinte

2. Tendinte Hardware

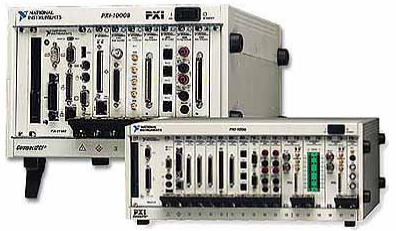


- "All in one"
  - Includerea pe aceeasi structura cu procesorul si a modulelor de intrari/iesiri si a consolei etc.
  - => necesita platforme software simple

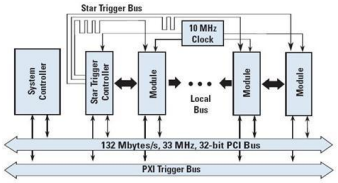


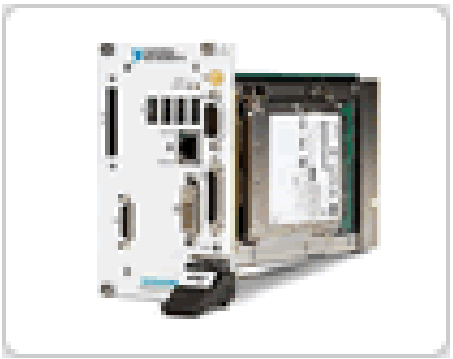
C10: Tendinte

2. Tendinte Hardware



- Putere de calcul foarte mare
  - Aducerea in zona “industriala” a procesoarelor si arhitecturilor din zona PC si Server;
  - Utilizarea acestora fara SO (Windows) doar cu un nucleu de TR;
  - Structuri multiprocesor pe care ruleaza multi-tasking real;
  - Calculatoare “de proces”

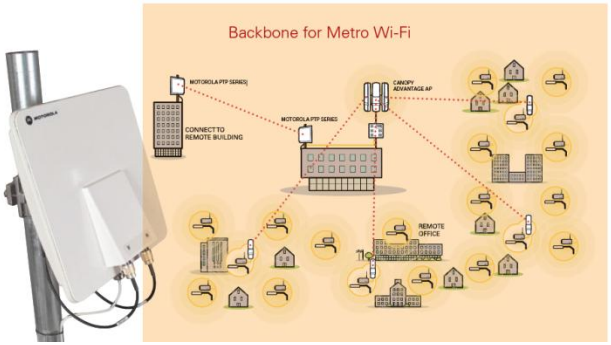


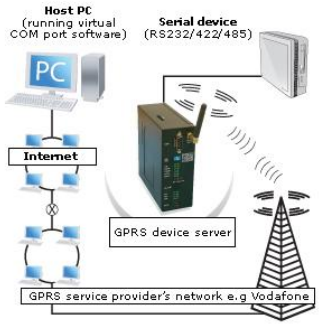


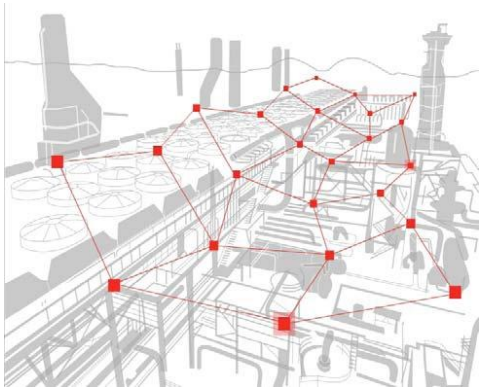
C10: Tendinte

2. Tendinte Hardware

- Utilizarea sistemelor de comunicatie moderne
  - Radio
  - GSM (GPRS)
  - Wireless
  - LoRa ???

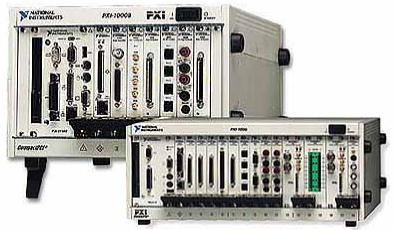




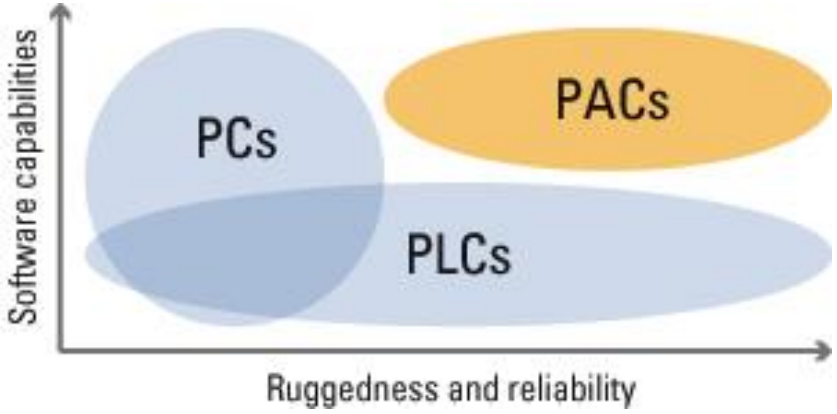


C10: Tendinte

2. Tendinte Hardware



- PAC
  - PAC - Integreaza beneficiile controllerelor programabile logic (!) (PLCs), performantelor deosebite de programare a PC-urilor şi hardware-ul personalizat. NI PACS, programat cu LabVIEW, CVI (C) combina fiabilitatea şi caracteristicile industriale ale PLC, PC şi circuitelor personalizate



C10: Tendinte

3. Tendinte Software

- **Bazate pe puterea de calcul mare**
  - Portabilitate;
  - Deschidere prin sistemele OPC Server;
  - Programare grafica.

```
// definirea unor constante ce corespund adreselor
// registrilor utilizati
#define ADL 0x224
#define ADH 0x225
#define AMP 0x229
#define MPX 0x22A
#define MOD 0x22B
#define TRG 0x22C
```

```
int ai(int canal)
{
        unsigned char h,l;
        // setare a modului de lucru al placii
        outp(MOD,0x01);
        // setarea amplificarii
        outp(AMP,0x02);
        // selectarea canalului citit
        outp(MPX,canal);
        // pauza pentru stabilizarea oscilatiilor
        delay(1);
        // declansarea operatiei de achizitie
        outp(TRG,0x00);
        // testare a sfarsitului de conversie
        /* do{
        h=inp(ADH);
        }while((h&0x10)==0x10); */
        delay(1);
        // preluarea rezultatului conversiei partea H x 256 + L
        h=inp(ADH)&0x0F;
        l=inp(ADL);
        return(256*h+l);
}
```

C10: Tendinte

```
// definirea unor constante ce corespund adreselor
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#define ADL 0x224
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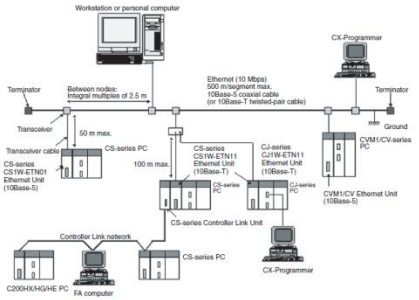
#define TRG 0x22C
```

3. Tendinte Software

- Portabilitate
  - Posibilitatea de a scrie o aplicatie in mai multe “limbaje”
  - Standardul IEC 61131
  - Limbaje utilizate:
    - ✓- Ladder Diagram (LD);
    - ✓ - Function Block Diagram (FBD);
    - ✓ - Structured Text (ST);
    - ✓ - Instructions List (IL);
    - ✓ - Sequential Function Charts (SFC);

C10: Tendinte

3. Tendinte Software



- Deschidere prin OPC Server
  - Cea mai simpla posibilitate de conectare a unor echipamente din familii (brand-ri) diferite este utilizarea unor arhitecturi OPC Server;
  - OPC Server-ul este implementat in general pe arhirecturi cu SO (Windows) unde este mult mai usor de “scris aplicatii”;
  - Exista o multitudine de produse pe piata, unele chiar gratuite.

```
// definirea unor constante ce corespund adreselor
// registrilor utilizati
#define ADL 0x224
#define ADH 0x225
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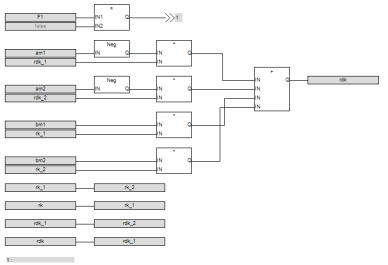
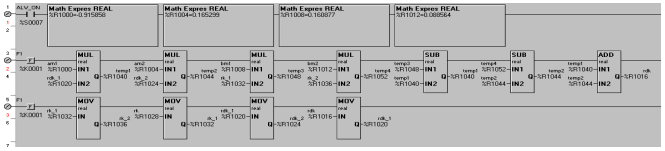
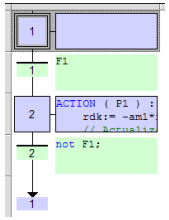
C10: Tendinte

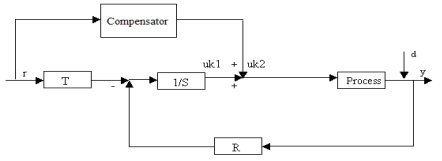
3. Tendinte Software



- Programare grafica
  - Mai usor de implementat aplicatii de catre un utilizator “general”;
  - Mai putin optime din punctul de vedere al “executabilelor” realizate;
  - Tendinte clare ale unor programe stiintifice (Matlab/Simulink) catre zona aplicatiilor reale.



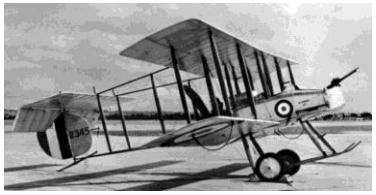


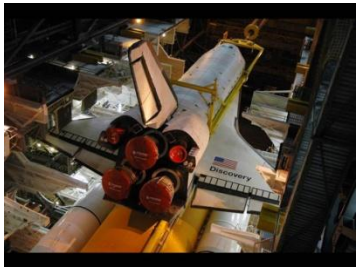


C10: Tendinte

4. Tendinte Algoritmi

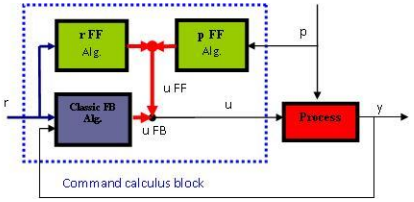
- **Optimizare – optimizare - optimizare**
  - Optimizarea algoritmilor de reglare
  - Optimizarea punctelor de functionare
  - Optimizare operationala – Asset management
  - Diagnoza a defectelor, reconfigurare



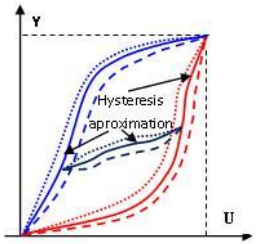


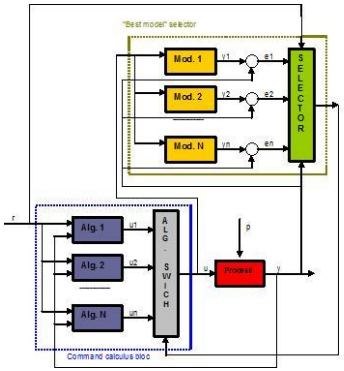
C10: Tendinte

4. Tendinte Algoritmi

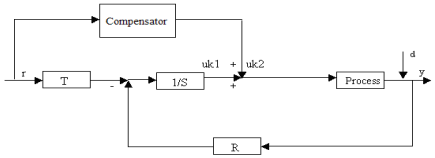


- Optimizarea algoritmilor de reglare
  - Structuri de reglare multimodel (amplificare var.);
  - Acordare pe baza de model;
  - Proiectare robusta;
  - Structuri cu compensarea neliniaritatilor.





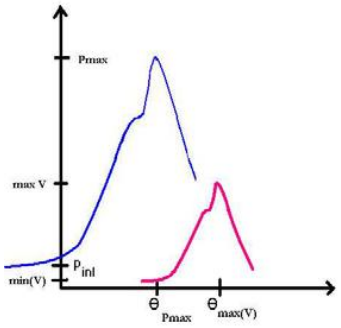
$$H_m(q^{-1}) = \frac{b_0 + b_1 q^{-1} + b_2 q^{-2}}{a_0 + a_1 q^{-1} + a_2 q^{-2}} = \frac{y(k)}{u(k)}$$

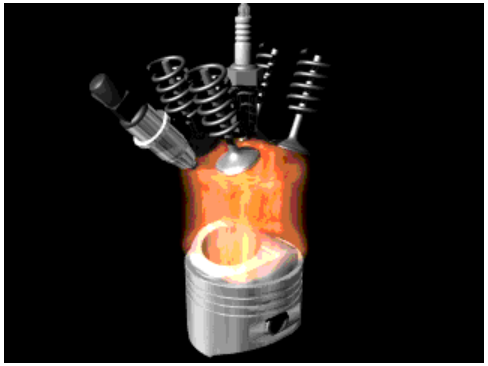


C10: Tendinte

4. Tendinte Algoritmi

- Optimizarea punctelor de functionare
  - Reprezinta principalul motor al ultimelor “modernizari”;
  - Metode de optimizare multivariabila cu restrictii;
  - Acordare pe baza de model.





C10: Tendinte

4. Tendinte Algoritmi

- Optimizare operationala
  - Baze de date cu toate componentele sistemului si toate caracteristicile acestora;
  - Jurnale de inlocuire;
  - Asset management.

C10: Tendinte

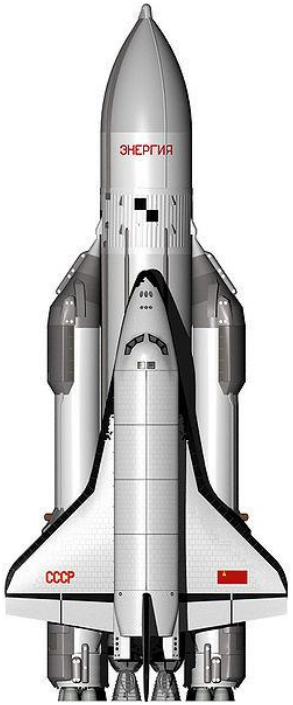
5. Exemple ...in ordine alfabetica:

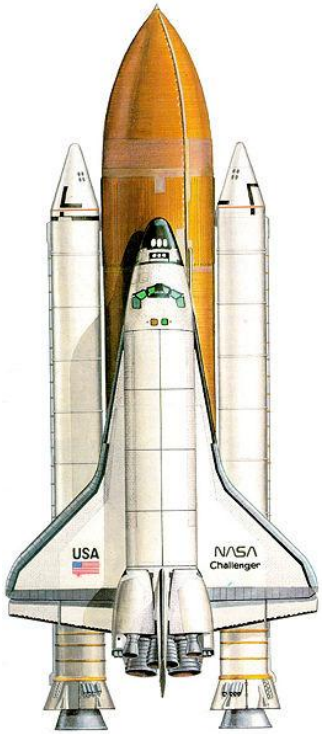
- **Aeronautica - (zona militara si spatiala)**:

C10: Tendinte

5. Exemple ...in ordine alfabetica:

- **Aeronautica - (zona militara si spatiala)**:

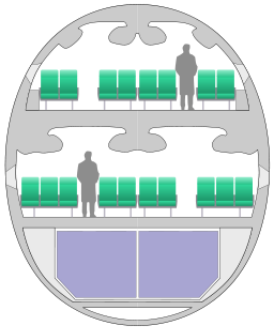


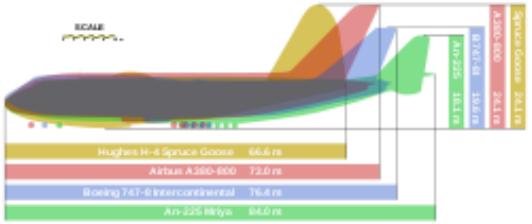


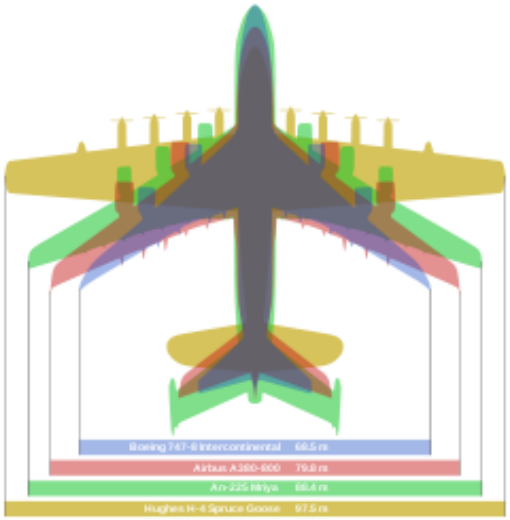
C10: Tendinte

5. Exemple ...in ordine alfabetica:

- **Aeronautica - (zona militara si spatiala)**:







C10: Tendinte

5. Exemple ...in ordine alfabetica:

- **Transport - (zona terestra civila)**:

C10: Tendinte

5. Exemple

- Optimizarea functionarii unui Cowper:

C10: Tendinte

6. Alte directii

- IoT
- Industry 4.0
- HIL – HWIL – hardware in the loop
- SIL – software in the loop
- HITL – human in the loop

…

C10: Tendinte

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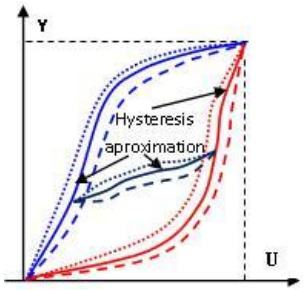

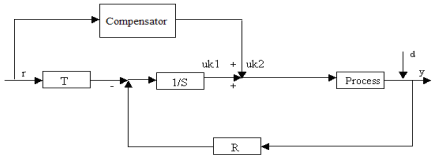

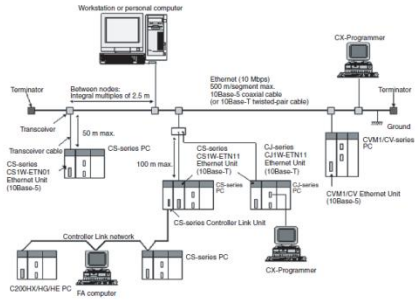

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