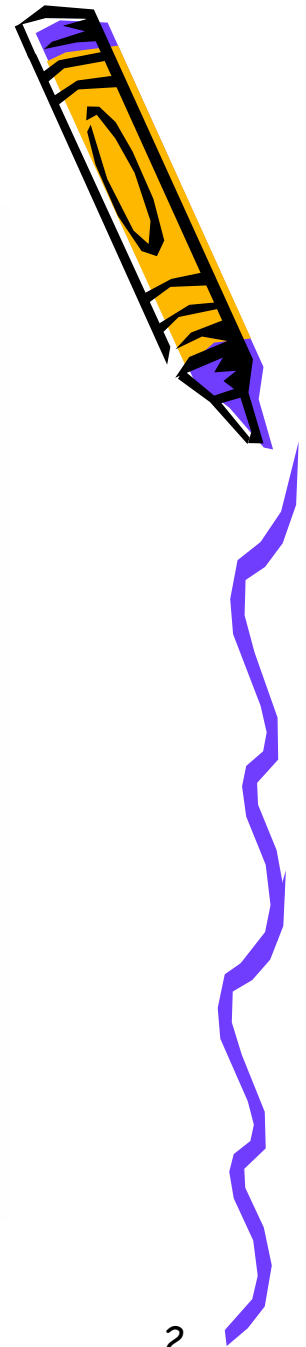
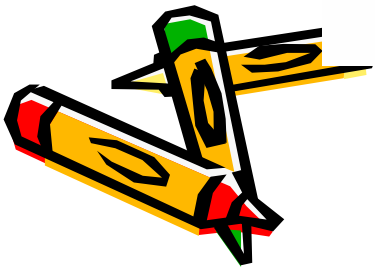
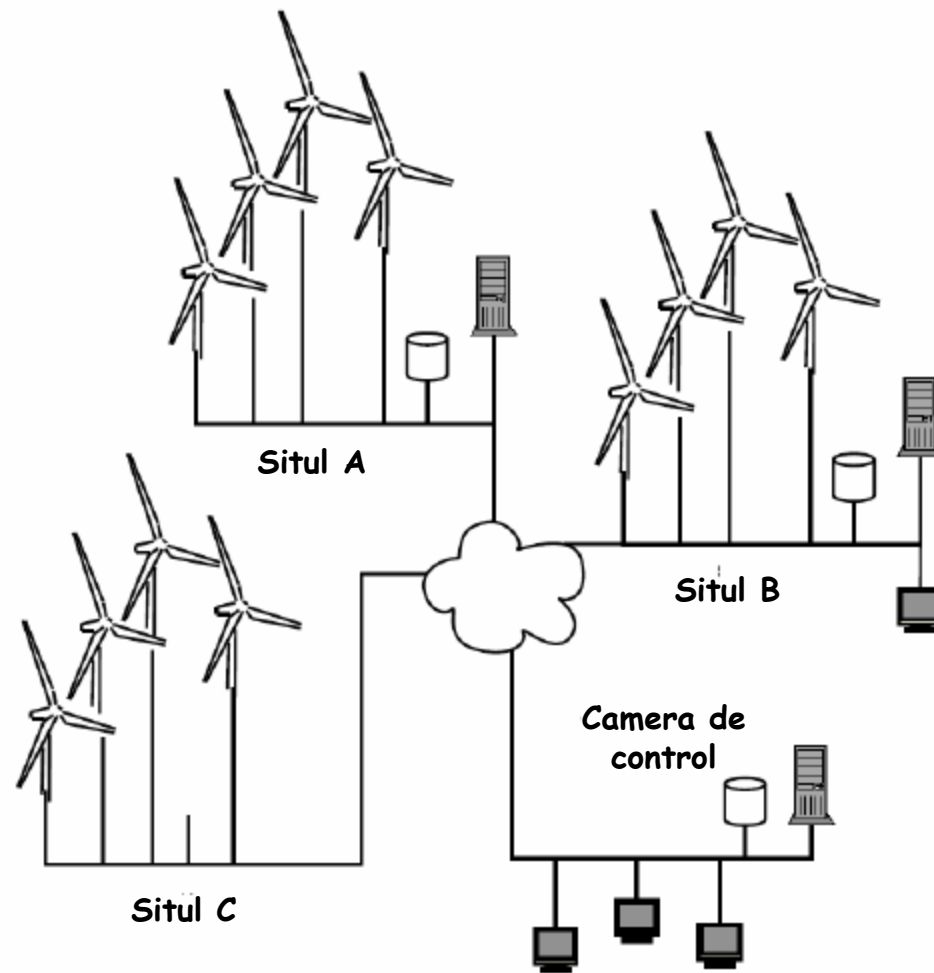


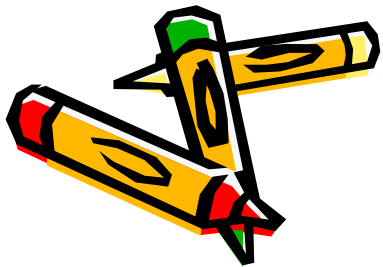
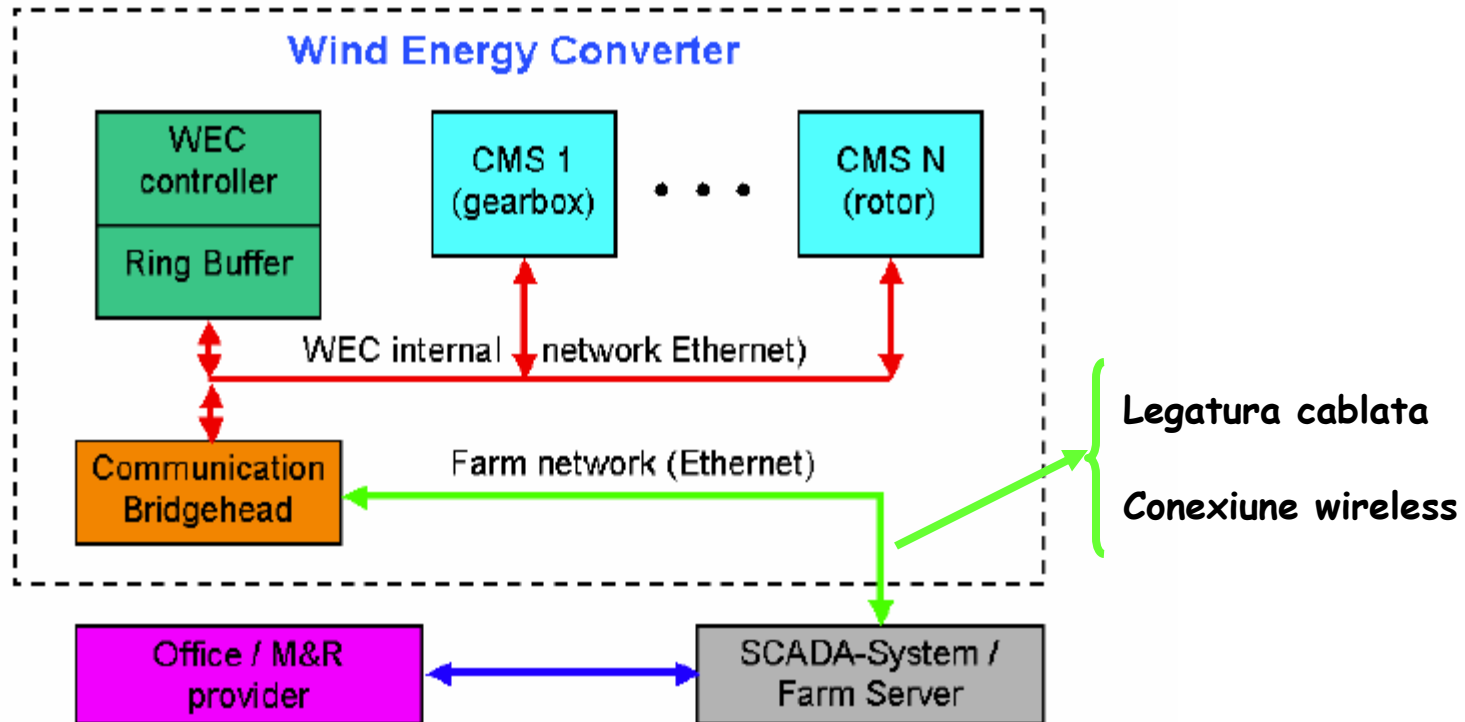


SISTEME DE MONITORIZARE SI DIAGNOZA PENTRU TURBINE EOLIENE

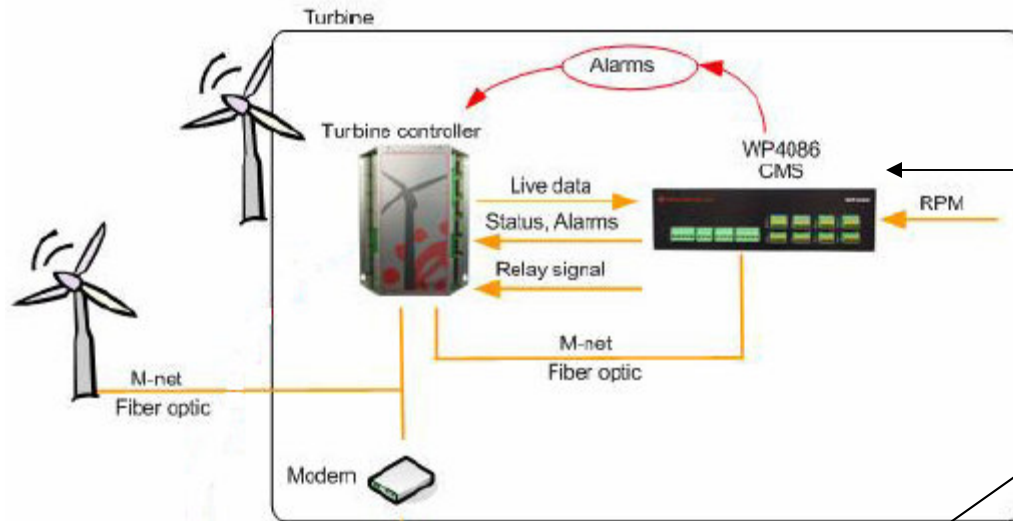
STRUCTURA UNUI SISTEM DE MONITORIZARE - componenta hardware



MOD DE COMUNICARE SI TRANSMISIE A DATELOR



Controlerul turbinei eoliene (WEP controller)



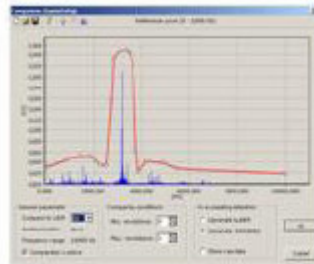
Module pentru fiecare componenta monitorizata

Alarm

Live Threshold validation by FFT Spectra every 5 sec.

Alarm log:

1. FFT Spectra + Raw data
2. Alarm FFT Peak
3. Signal above thresholds and vibration level

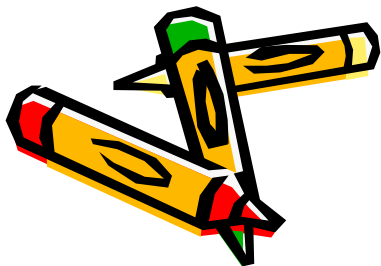


Daily dataset. Trend

4 data sets per day:
 FFT Spectra
 Raw data

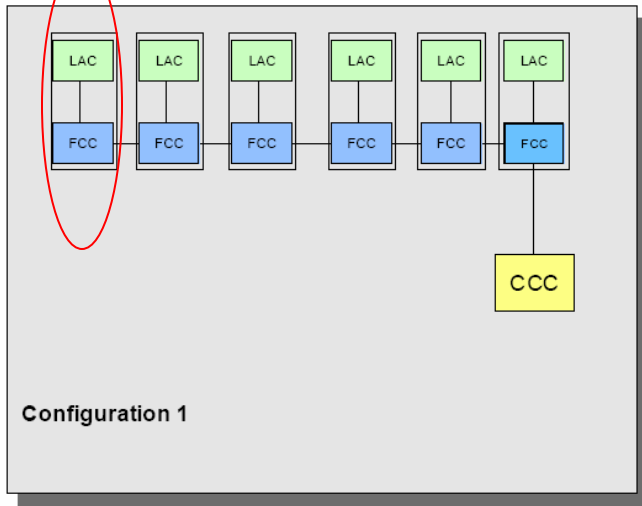
Memory for 5 days in WP4086

Raw data = 4096 samples

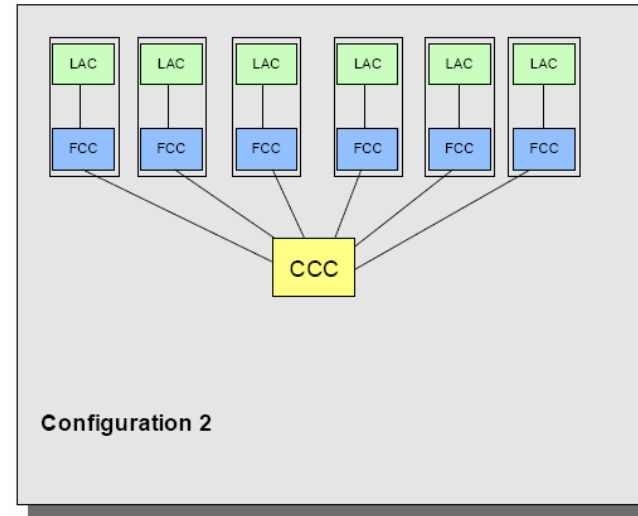


Componenta de monitorizare


Bloc de comunicatii



Varianta serie



Varianta paralela

 LAC Local Acquisition Center

 FCC Field Control Center

 CCC Company Control Center

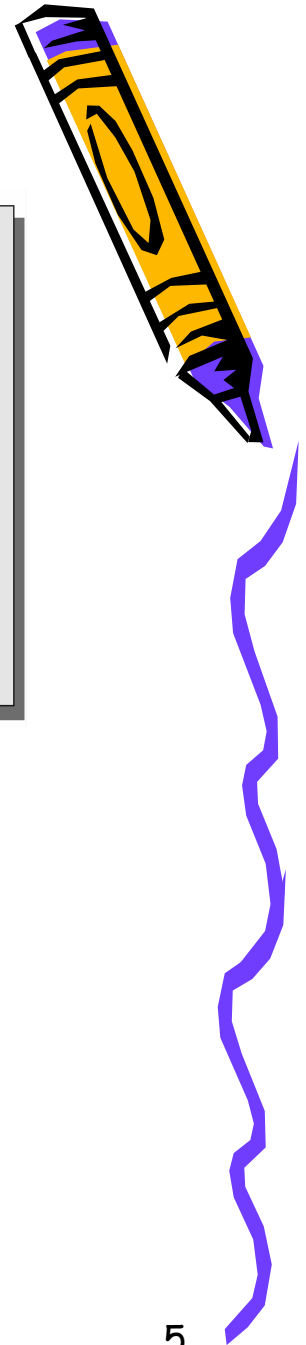
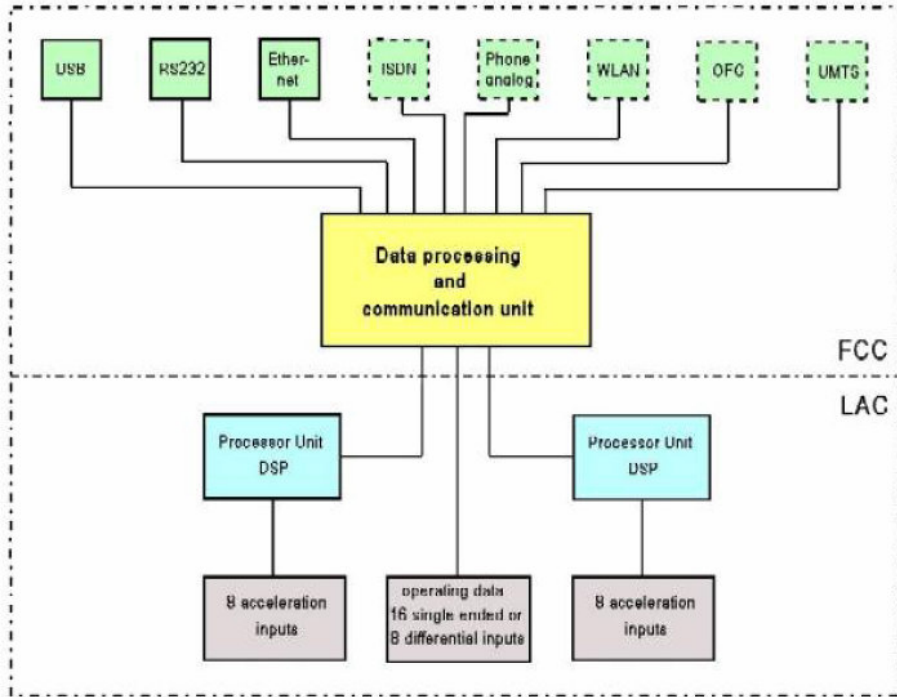
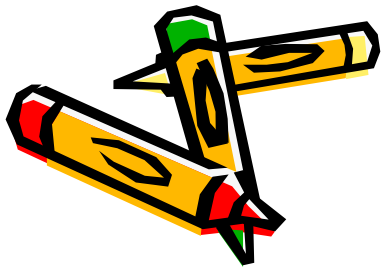


Diagrama blocului de comunicatii



Componenta ce asigura comunicarea cu exteriorul

Componenta ce asigura comunicarea cu elementele turbinei, colectarea si procesarea locala a datelor



STRUCTURA UNUI SISTEM DE MONITORIZARE - Componenta software

Schimbul de **date** si **comunicarea**

Date transmise in timp real

Sunt necesare in mod continuu
Importante in monitorizarea si diagnoza
sistemului

Date de termen lung

Date care se apeleaza numai la anumite
intervale de timp

**Standardul utilizat:
IEC61400-25**



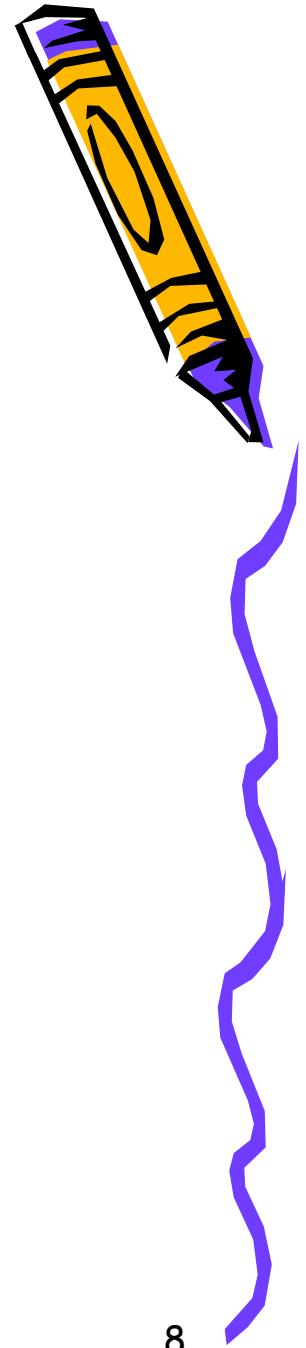
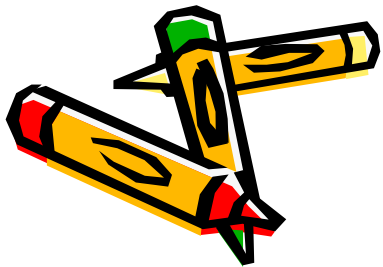
Stocarea datelor

Tipul fisierului utilizat: XML

Header: Informatii asupra
sitelui, turbinei, componentei
Continut: Datele propriu-zise

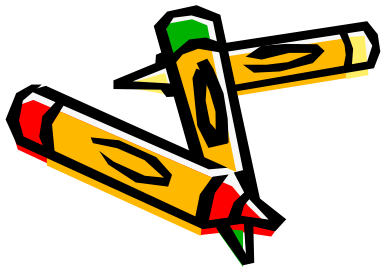
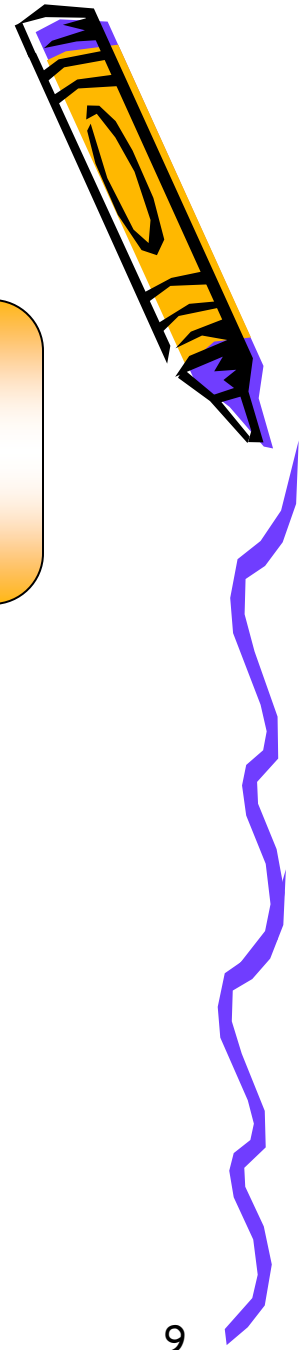
Tipuri de documente:

- Centrate pe date: sunt utilizate pentru transportul datelor
- Centrate pe document: sunt utilizate pentru stocarea si manipularea documentelor de tip brosure, ghiduri de utilizare, etc.



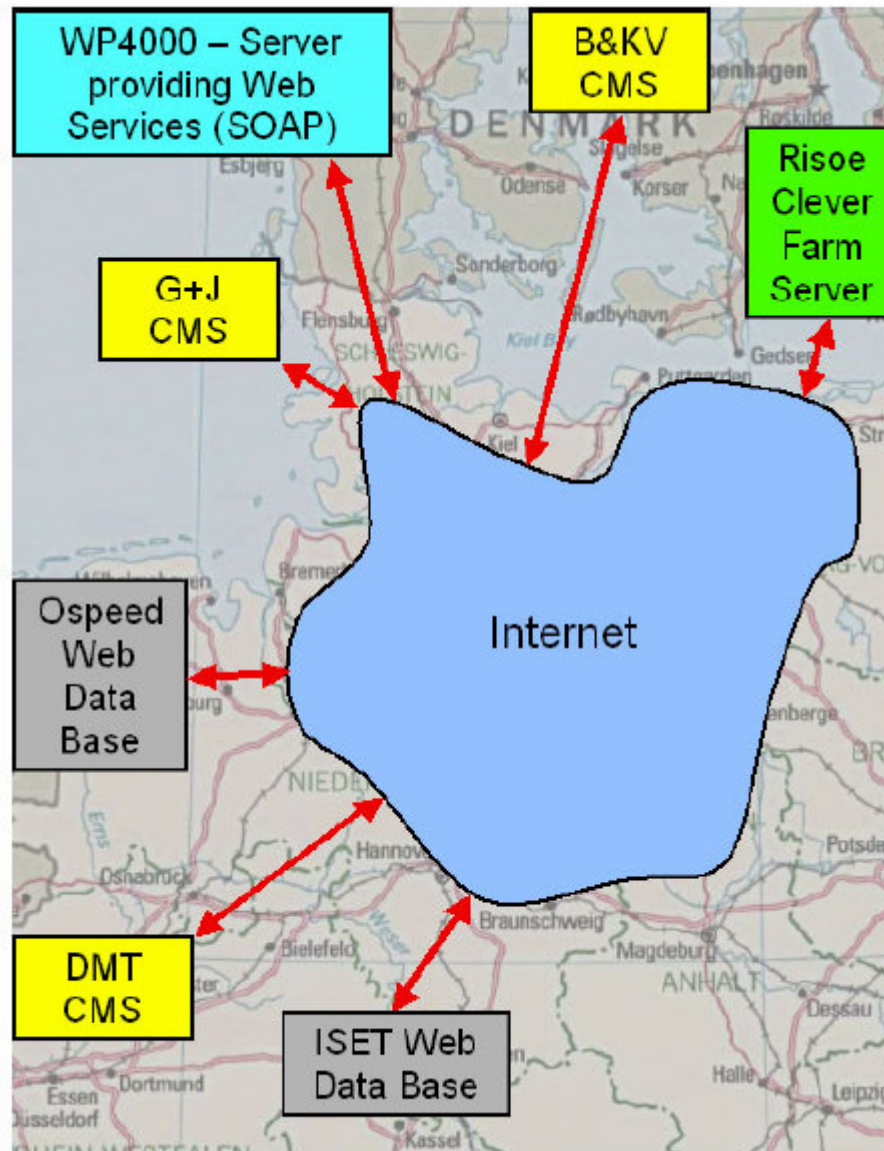
Evaluarea datelor

- Algoritmi de monitorizare si diagnoza implementati in sistemul de monitorizare (CMS)
- Preiau si analizeaza datele si listeaza posibile defecte in sistem



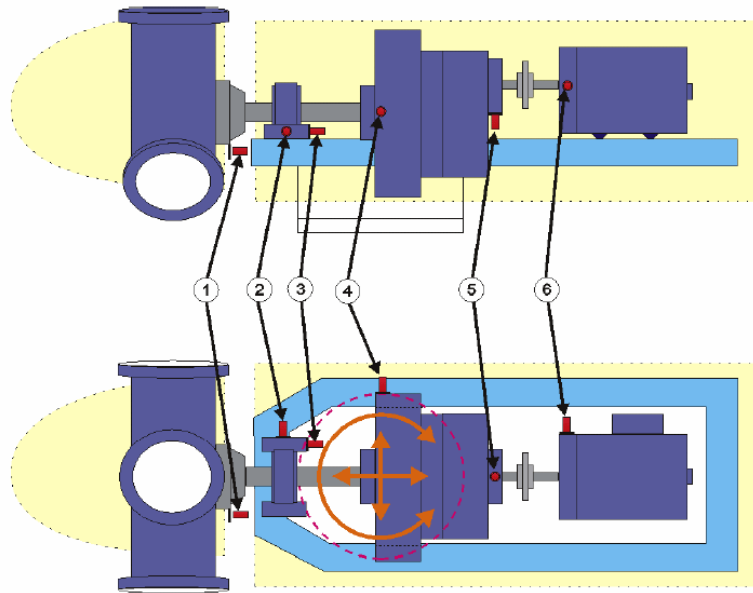
STUDIU DE CAZ

Distributia geografica a sistemelor eoliene (ferme) incluse in program



Mentenanata sistemelor industriale - Curs 11

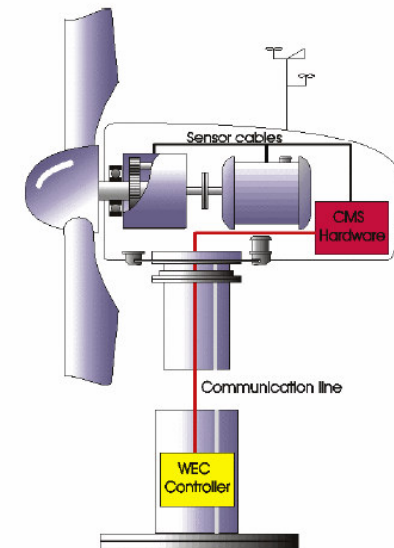




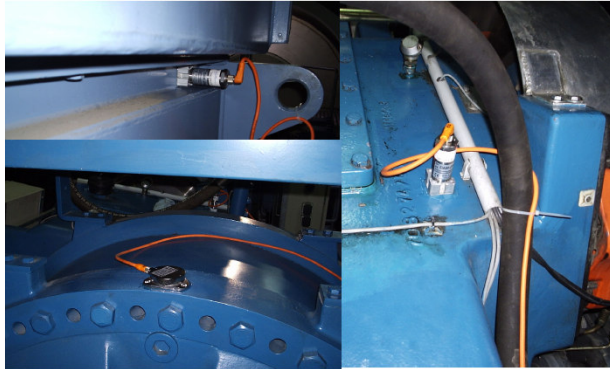
Instalarea senzorilor pe o turbina eoliana

- 1 - senzor inductiv pentru determinarea pozitiei absolute a rotorului
- 2, 3, 4 - accelerometre pentru determinarea oscilatiilor pe directie axiala si transversala ale nacelei
- 5, 6 - accelerometre operand la frecvente cuprinse in domeniul 1-20000Hz pentru vibratiile induse in cutia de viteze si in lagare

Instalarea sistemului de monitorizare si conectarea acestuia la senzori si controlerul turbinei eoliene

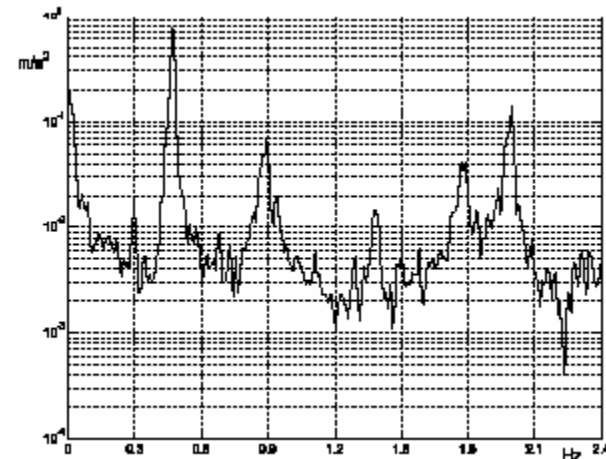
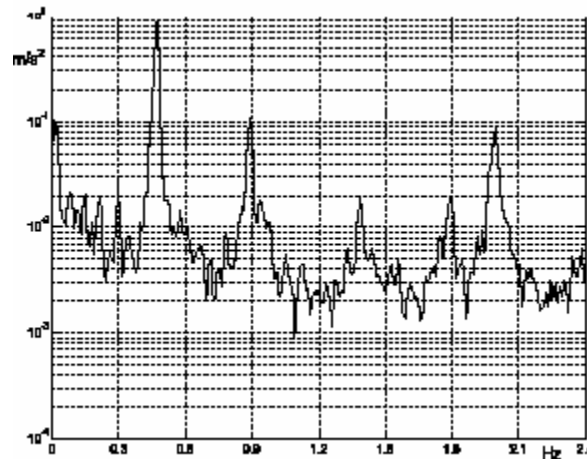


Turbina eoliana S70 - Stassfurt, Germania

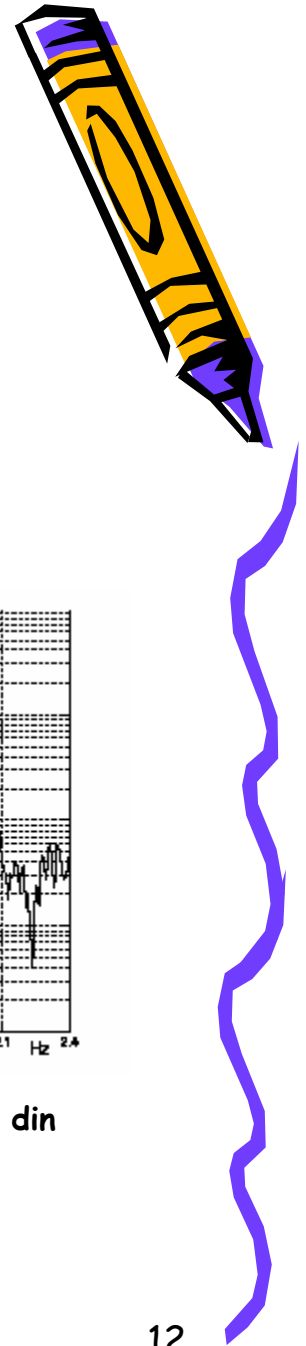


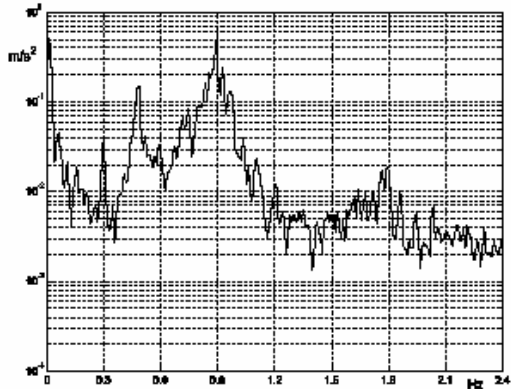
2 senzori pentru detectia si masurarea oscilatiilor nacelei pe directie axiala si transversala (senzori de joasa frecventa, 0.1-10Hz).

1 senzor pentru detectia si masurarea vibratiilor cutiei de viteze (senzori de frecventa inalta, de la cativa herti la 10 kHz).

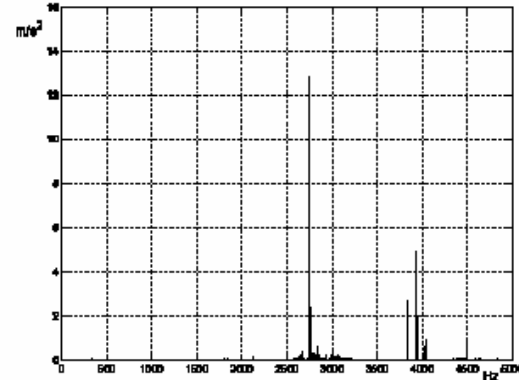
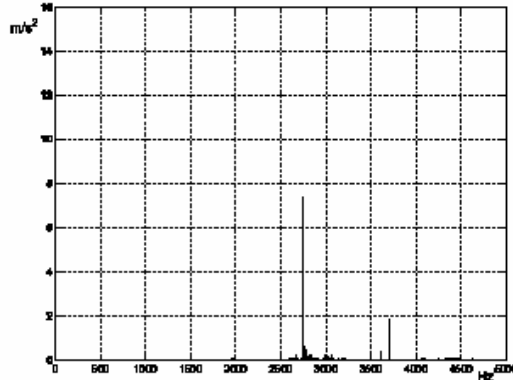


Spectrul de frecventa al oscilatiilor transversale ale nacelei, in partea din fata (stanga) si in cea din spate (dreapta)

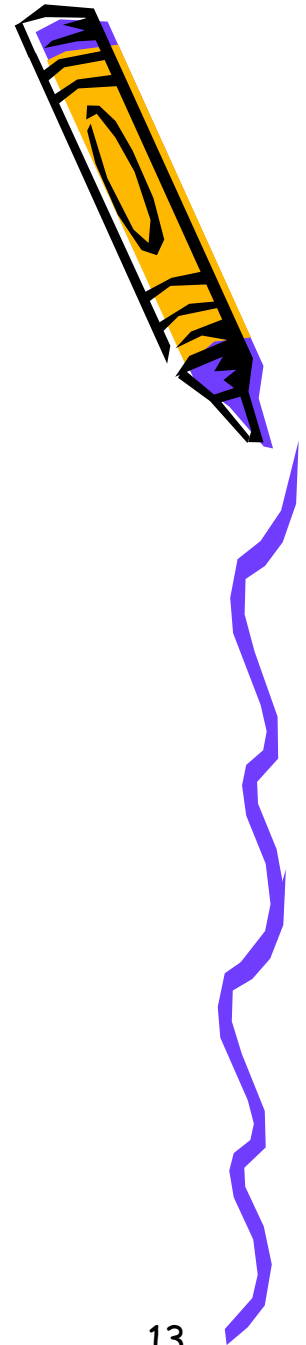




Spectrul de frecventa al oscilatiilor la nivelul cutiei de viteze



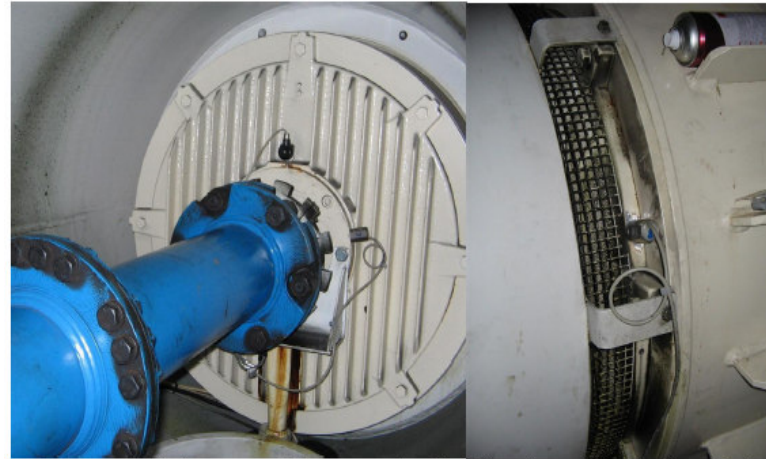
Spectrul de frecventa al oscilatiilor la nivelul lagarelor generatorului pentru viteza de 1544rpm (25.73Hz) respectiv la 1642rpm(27.37Hz)



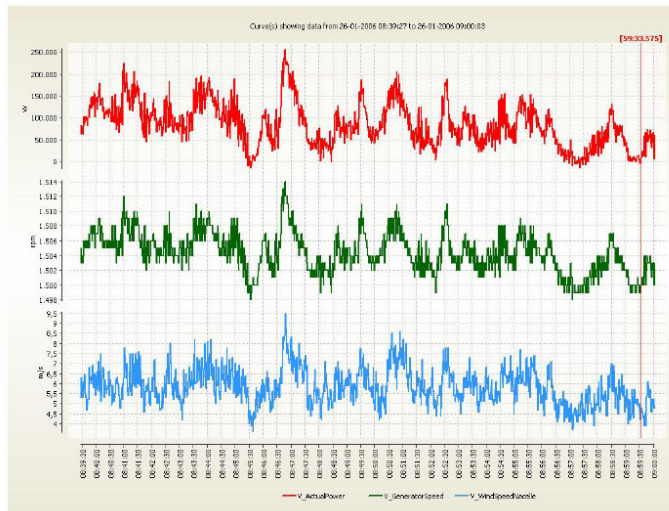
Turbina eoliana Nordic 1000



Senzori instalati pe cutia de viteze, respectiv pe rotorul turbinii



Senzori instalati pe scuturile frontal si din spate ale generatorului

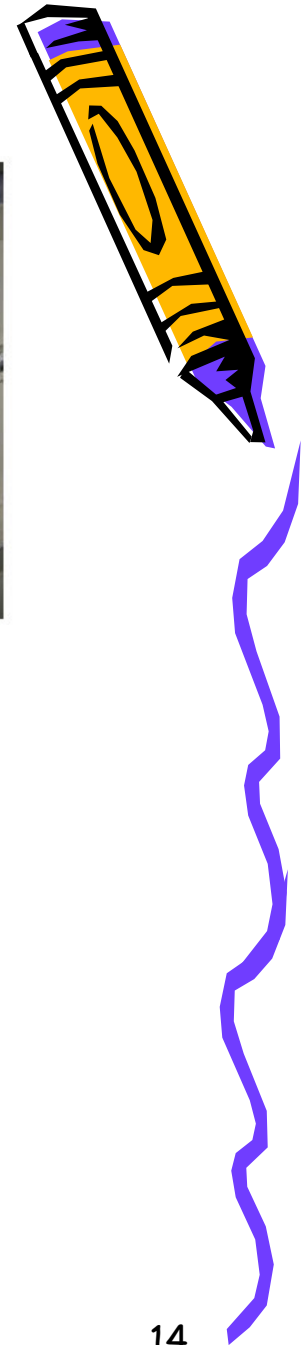


Puterea de iesire

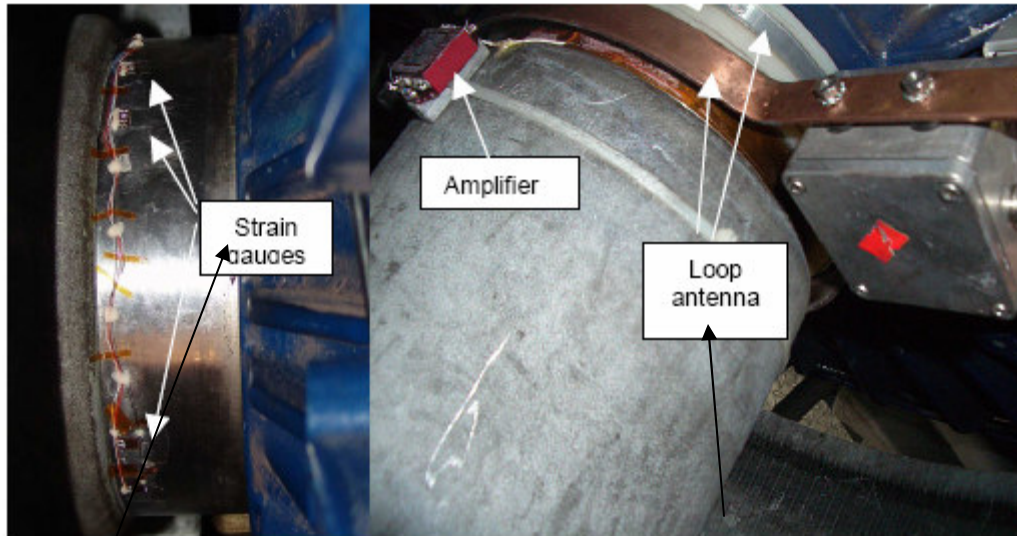
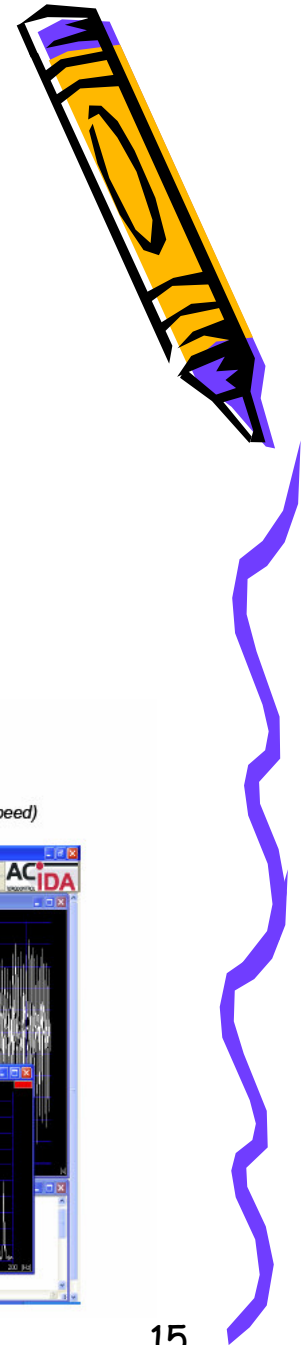
Viteza generatorului

Viteza vantului

Mentenananta sistemelor industriale - Curs 11



Turbina eoliana Vestas V90



Tensometre

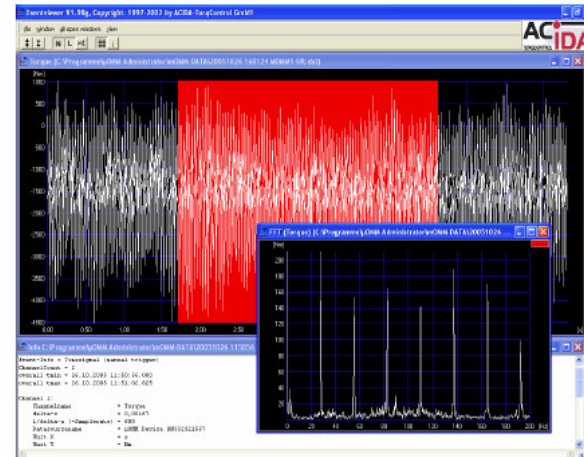
Strain gauges

Amplifier

Loop antenna

Antena pentru transmiterea datelor

Average data values during the measurement evaluations:
 Wind speed: 5 m/s
 Electrical power: 220 kW
 Rotation speed: 1680 rpm
 Measured torque ~ 1500 Nm
 Mechanical power = 235 kW (2 x PI x torque x rotation speed)



Mentenananta sistemelor industriale - Curs 11