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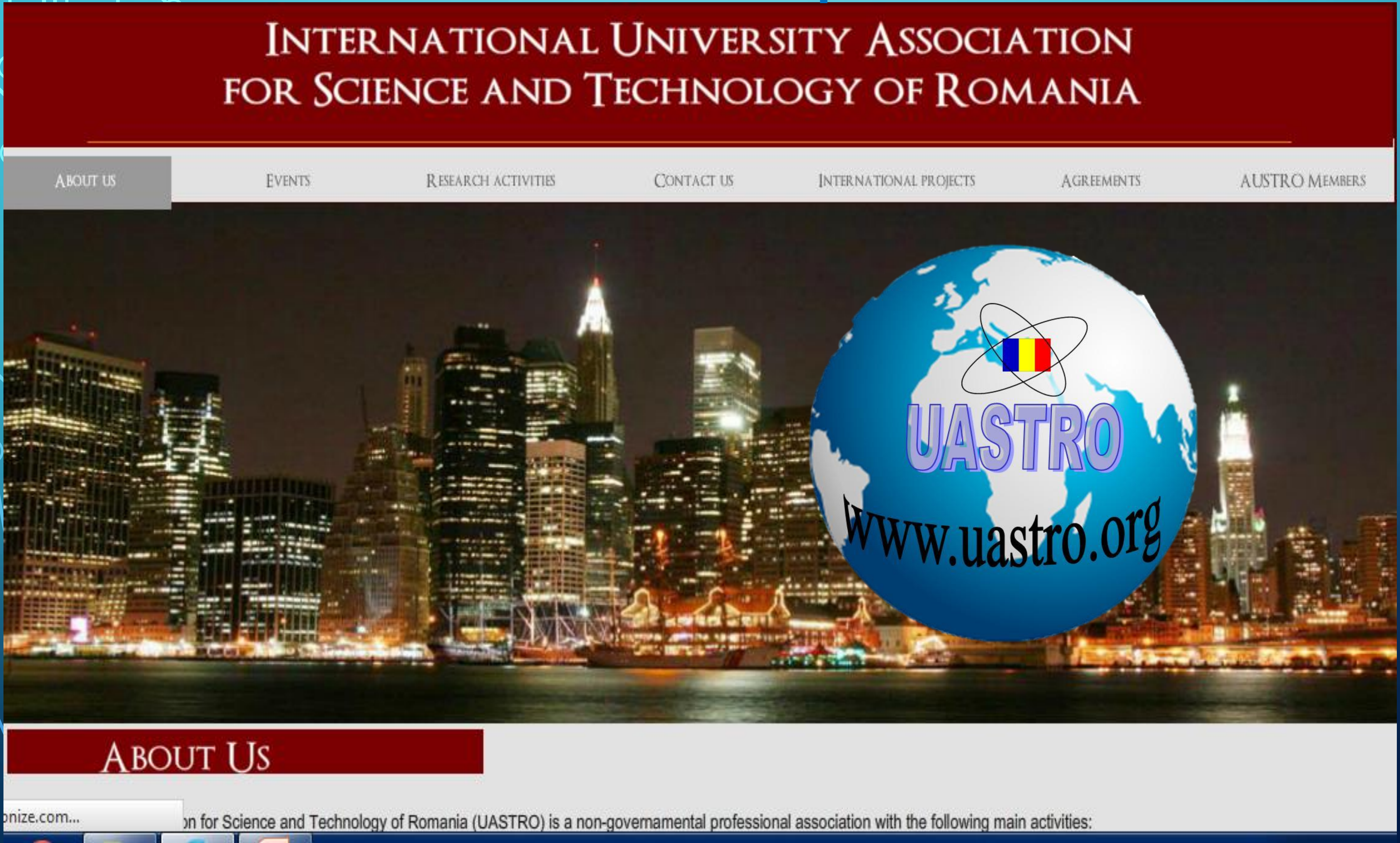

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- March 25 News! We have updated the editorial board list of IJEEE!
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The certificate of acceptance for the manuscript (**mathematics-2947149**) titled:

Monitoring the wear trend in wind turbines by tracking the Fourier vibration spectrum and base density support vector machine

Authored by:

Claudiu Bisu; Adrian Olaru; Serban Olaru; Adrian Alexei; Niculae Mihai; Haleema Ushaq

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Base Density Support Vector Machine for Optimization

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El Moutaouakil K, El Ouissari A, Olaru A, Palade V, Ciorei M. OPT-RNN-DBSVM: OPTimal Recurrent Neural Network and Density-Based Support Vector Machine. *Mathematics*. 2023; 11(16):3555. https://doi.org/10.3390/math11163555.

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1. Generality about the Support Vector Machine learning (SVM)
2. Mathematical model of the Base Density Support Vector Machine (BDSVM)
3. Description of the LabView used Virtual Instrumentation
4. Case study of Optimisation the Company Stock of one private company
5. Application of the DBSVM
6. Conclusions
7. Future work
8. References

1. Generality about the Support Vector Machine learning (SVM)

Support Vector Machine (SVM) is a supervised classification method **derived from statistical learning theory** that often provides good classification results from complex data that includes:

-both correct data

-and noise or outliers.

SVM separates the collected data into classes through a decision limit, which maximizes the margin of obtaining correct data between the classes addressed.

The surface between them is called the optimal hyperplane [1]-[3], and **the data points closest to the hyperplane are called support vectors.**

The support vectors are the critical elements of the training set.
You can adapt SVM to become a non-linear classifier by using **non-linear kernels**.

While SVM is a binary classifier in its simplest form, **it can work as a multiclass classifier by combining multiple binary SVM classifiers** (creating a binary classifier for each possible pair of classes).

SVM includes a penalty parameter that allows for some degree of misclassification, which is particularly important for non-separable training sets.

- **SVM was introduced by Vapnik and his colleagues in the 1970s**, but its major developments were formulated in the **1990**s.
- The main objectives of the **Base Density of SVM are:** reducing the effects of outliers, maximizing the decision to obtain the optimal boundary between data sets, ensuring better generalization and adjusting the decision boundary according to the density of the data sets.
- **Base density SVM** can detect outliers or data points that are outside the densely populated area, singular or erroneous points.
- Data points that are located in the densely populated area will be considered important (**meaningful**) points and others as less important (**meaningless**), which may be misclassified or ignored.
- The concept of population density is used to develop **Density-Based SVM**, in this method was calculated the distance (Euclidean and Mahalanobis) between the data points of a data set; this plays a major role in determining the area of high population density.

2. Mathematical model of the Base Density Support Vector Machine (BDSVM)

Suppose a two-dimensional data set is given by $\{(x_1,y_1),(x_2,y_2), \ldots (x_n,y_n)\}$.

the Euclidean distance between point 1 and 2, 3, ... , n and the Euclidean distance between point 2 at 1, 3, ..., n and so on.

$$d_{12} = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2}$$

$$d_{13} = \sqrt{(x_1 - x_3)^2 + (y_1 - y_3)^2}$$

…

$$d_{1n} = \sqrt{(x_1 - x_n)^2 + (y_1 - y_n)^2}$$

The distance average of d_1 is:

$$d_1 = \frac{d_{12} + d_{13} + \cdots + d_{1n}}{n - 1}$$

The total distance average of the group is:

$$d = \frac{d_1 + d_2 + \cdots + d_n}{n}$$

If d_i >d,

the point *i* is in outlier group;

Else

the point *i* will be considered important (meaningful) points in BDSVM;

End.

The Mahalanobis distance is calculated from the quantity μ which represents the average of the points' distances, to each point.

The cov^{-1} represents the inverse covariance matrix. This distance is based on the correlation between the variables or the variance-covariance matrix [11]-[12].

The Mahalanobis distance is the smaller unit and takes into account the correlation of the data set and does not depend on the measurement scale [9]-[10].The Mahalanobis distance from the point to the mean of the distribution μ can be calculated by (9),

$$d = \sqrt{(x-\mu)^T cov^{-1}(x-\mu)}$$

and the Mahalanobis distance from one point to another can be calculated by (10):

$$d = \sqrt{(x-y)^T cov^{-1}(x-y)}$$

$$var(x_n) = \frac{\sum_1^n (x-\mu)^2}{n}$$

$$cov(x_n, y_n) = \frac{\sum_1^n (x_i-\mu_x)(y_i-\mu_y)}{n}$$

Condition of the Mahalanobis method:

If $cov(x_i)$ & $cov(y_i)>0$

both of them increase or decrease;

If $cov(x_i)$ & $cov(y_i)<0$

when x_i increase y_i decrease or vice-versa;

If $cov(x_i)$ & $cov(y_i)=0$

not exist any relation between x_i & y_i;

If $var(x_i)> var(y_i)$

x_i increase or decrease faster than y_i;

End.

Average of d is:

$$average\_d = \frac{\sum_1^n \sqrt{(x_i - \mu)^T cov^{-1} (x_i - \mu)}}{n}$$

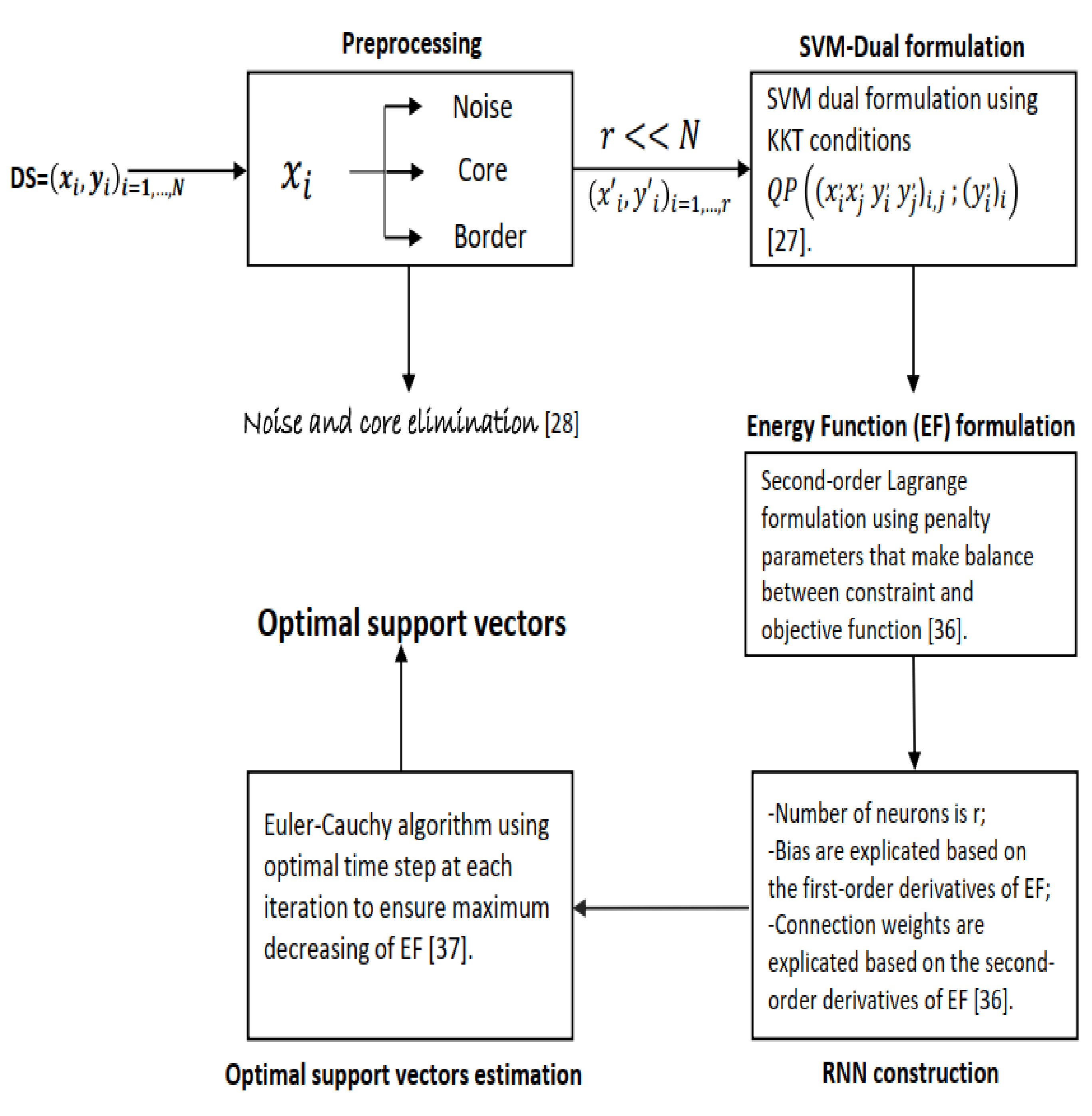
If d_i >d,

the point i is in outlier group;

Else

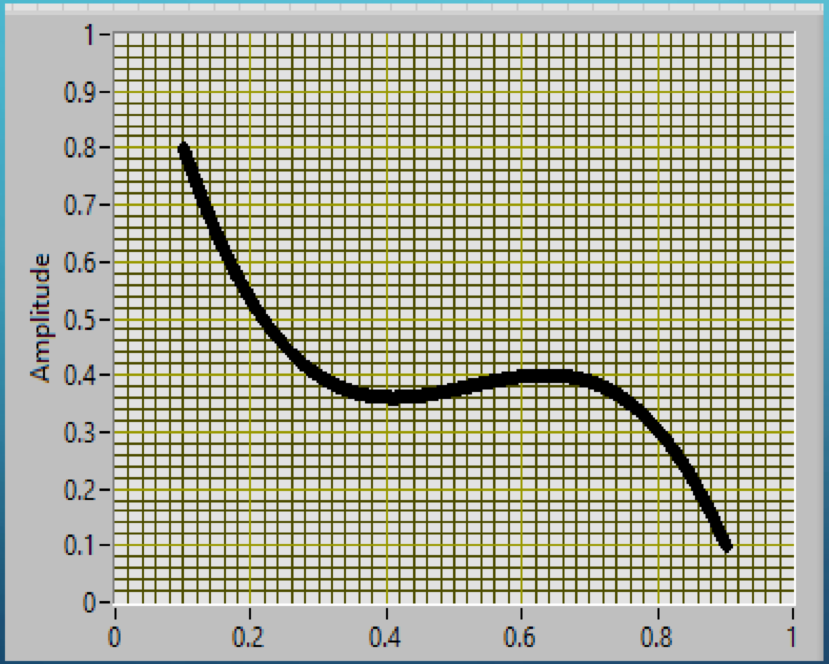
the point i will be considered important (meaningful) points in BDSVM;

End.

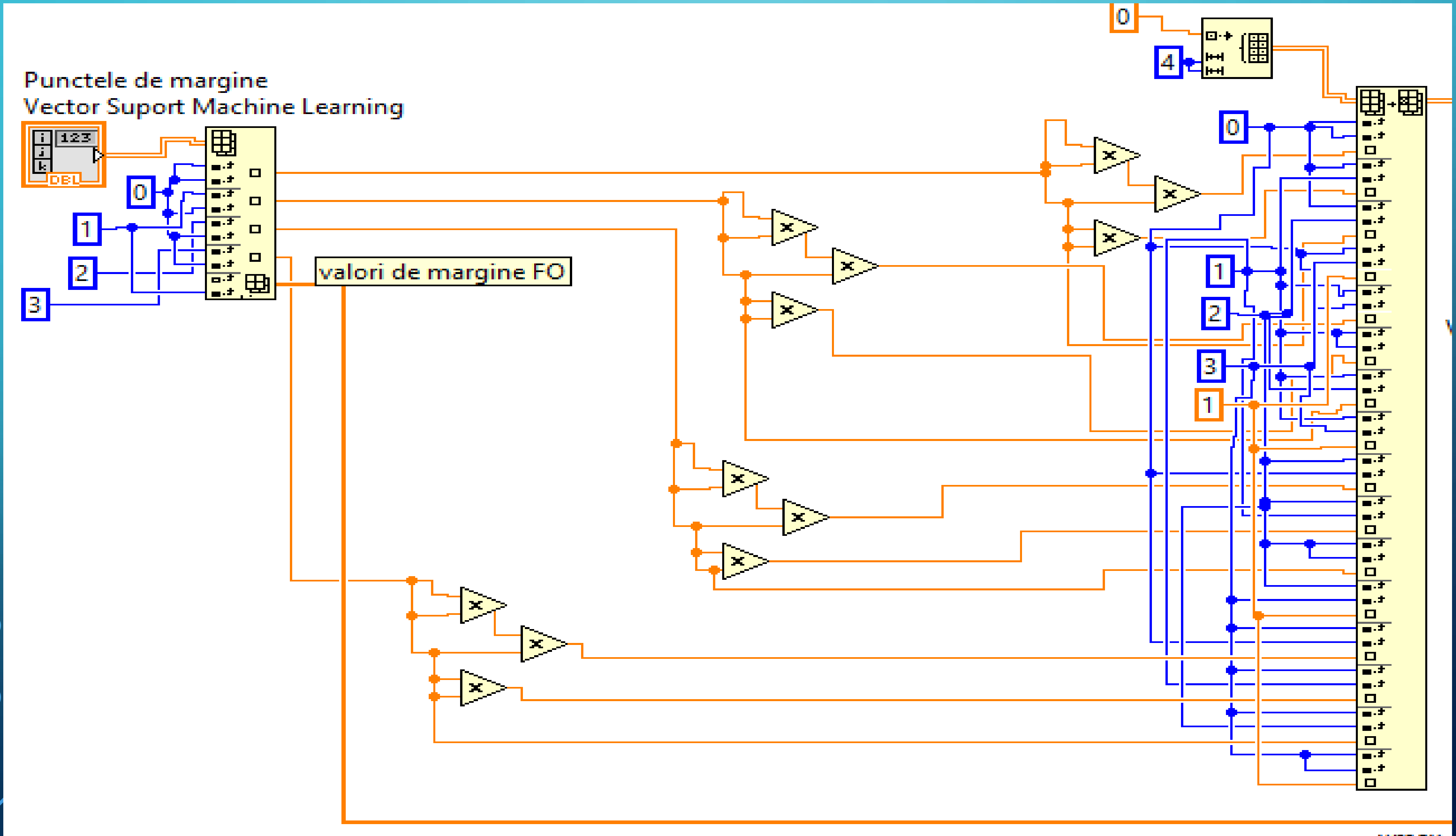

Preprocessing
SVM-Dual formulation
DS=$(x_i, y_i)_{i=1,\dots,N}$
x_i
Noise
Core
Border
$r << N$
$(x'_i, y'_i)_{i=1,\dots,r}$
SVM dual formulation using KKT conditions
$QP\left((x'_i x'_j\, y'_i\, y'_j)_{i,j}\,;(y'_i)_i\right)$
[27].
Noise and core elimination [28]
Energy Function (EF) formulation
Second-order Lagrange formulation using penalty parameters that make balance between constraint and objective function [36].
Optimal support vectors
Euler-Cauchy algorithm using optimal time step at each iteration to ensure maximum decreasing of EF [37].
-Number of neurons is r;
-Bias are explicated based on the first-order derivatives of EF;
-Connection weights are explicated based on the second-order derivatives of EF [36].
Optimal support vectors estimation
RNN construction

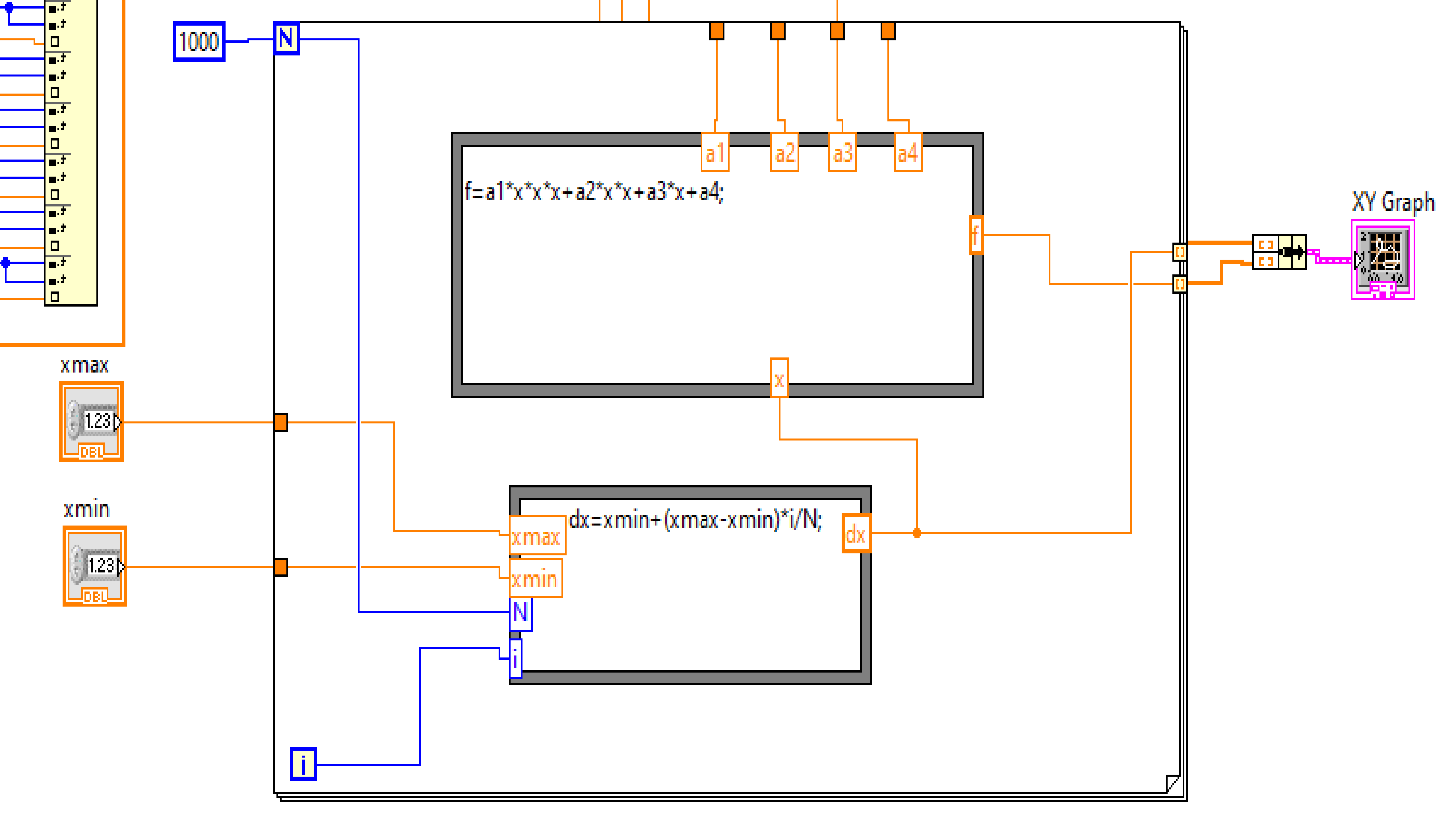
To establish the optimal number of the stock products was used the A,B,C theory that impose the following data [13]:

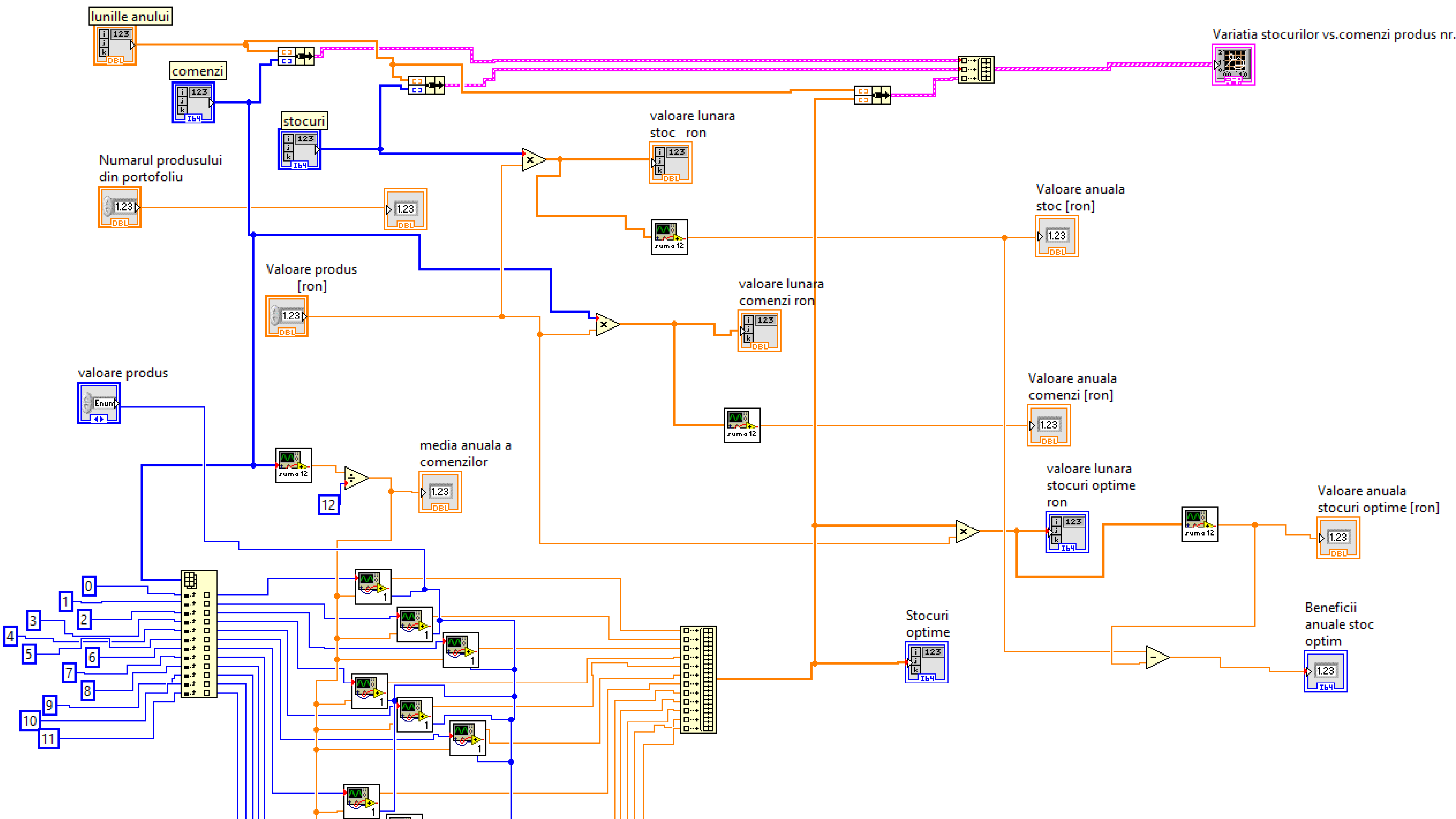
- A- contents the products with 20% from the total number of the products and 80% of total value of products;
- B- contents the products with 30% from the total number of the products and 15% of total value of products;
- C- contents the products with 50% from the total number of the products and 5% of total value of products;



3. Description of the LabView used Virtual Instrumentation




1000
N
a1
a2
a3
a4
f=a1*x*x*x+a2*x*x+a3*x+a4;
f
x
XY Graph
xmax
1.23
DBL
xmin
1.23
DBL
dx=xmin+(xmax-xmin)*i/N;
xmax
xmin
N
i
dx
i


lunille anului
comenzi
stocuri
Numarul produsului din portofoliu
Valoare produs [ron]
valoare produs
media anuala a comenzilor
12
valoare lunara stoc ron
valoare lunara comenzi ron
Valoare anuala stoc [ron]
Valoare anuala comenzi [ron]
valoare lunara stocuri optime ron
Valoare anuala stocuri optime [ron]
Stocuri optime
Beneficii anuale stoc optim
Variatia stocurilor vs.comenzi produs nr.
0
1
2
3
4
5
6
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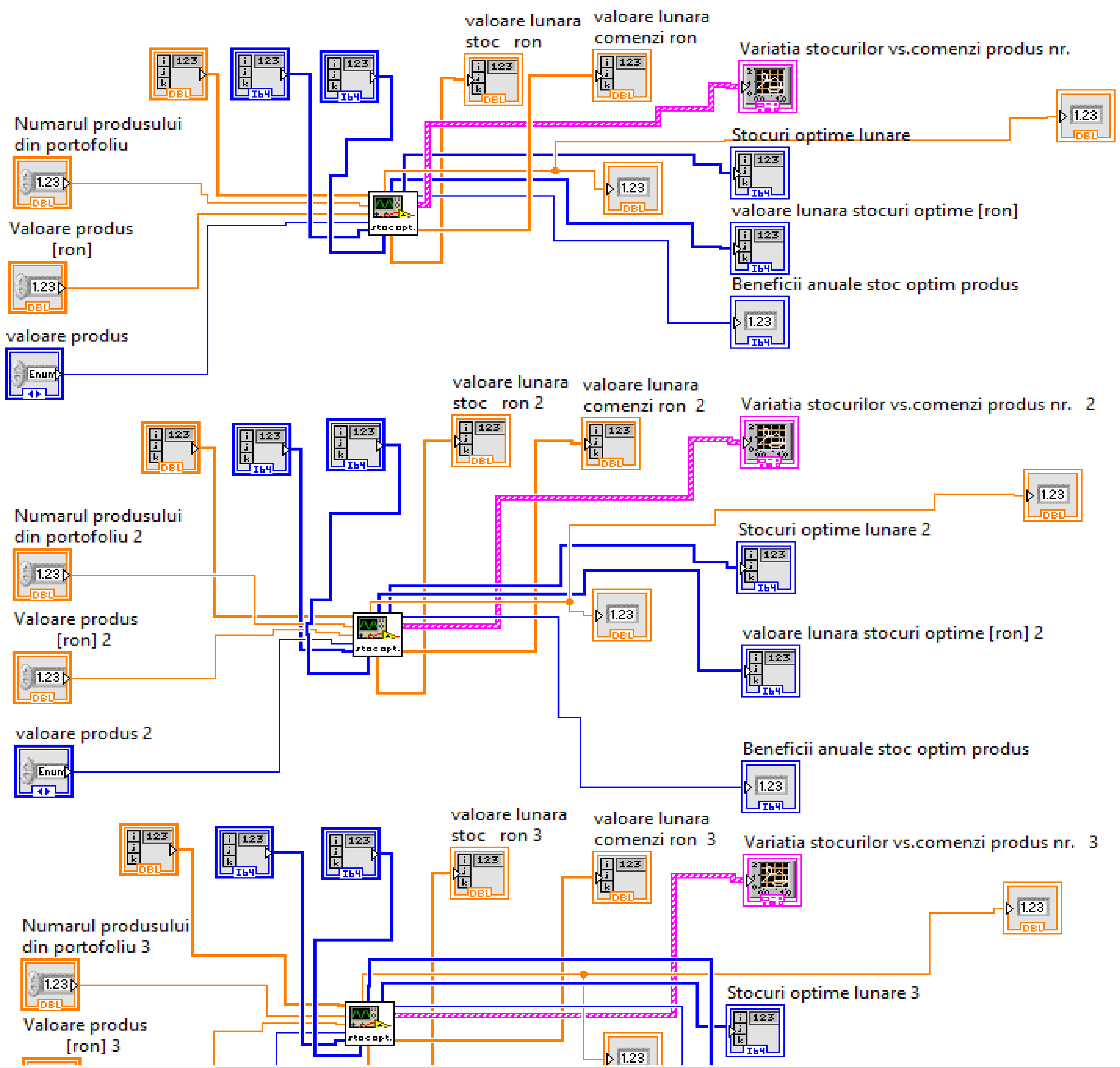
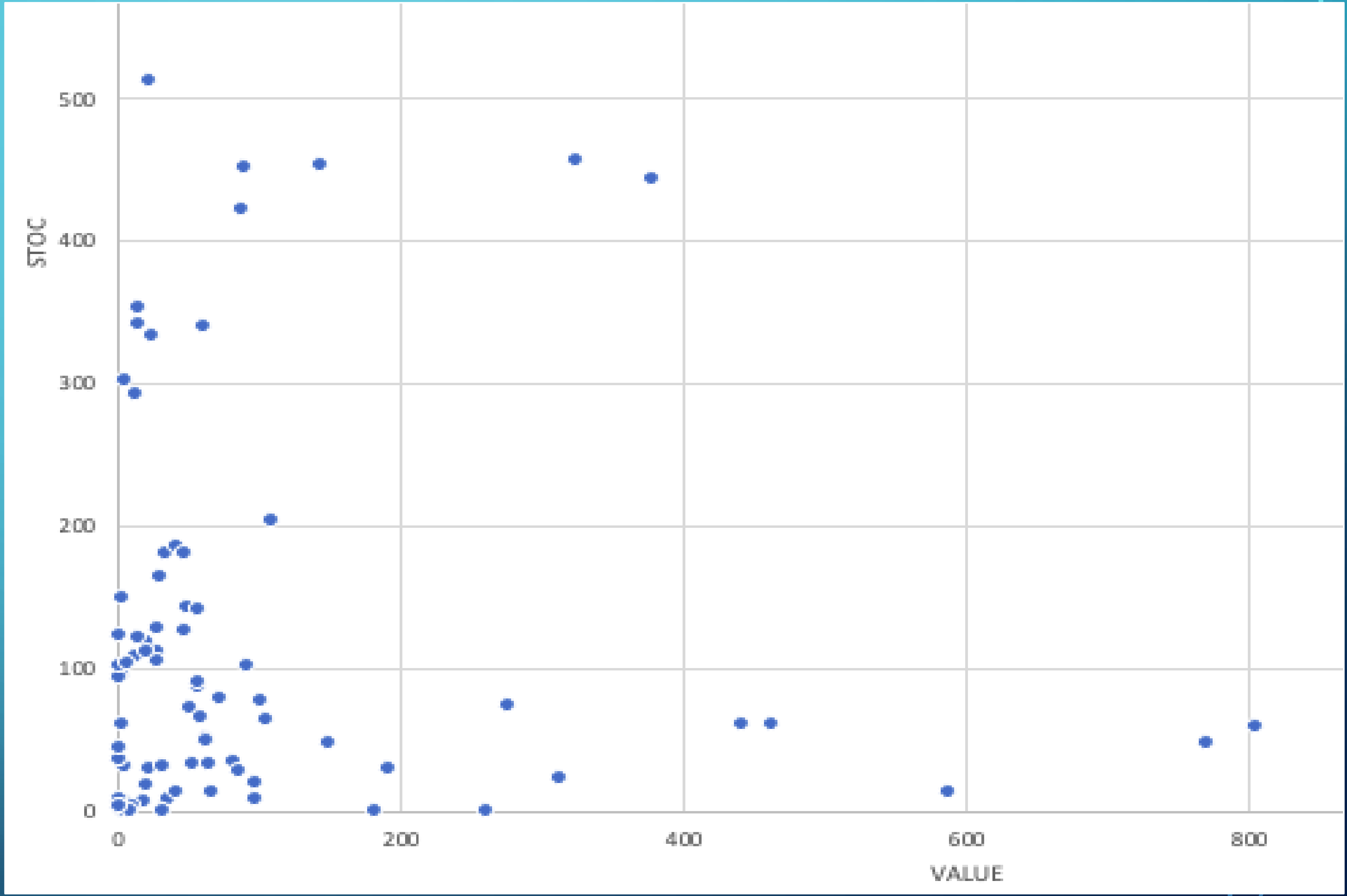
8
9
10
11


valoare lunara stoc ron
valoare lunara comenzi ron
Variatia stocurilor vs.comenzi produs nr.
Numarul produsului din portofoliu
Stocuri optime lunare
Valoare produs [ron]
valoare lunara stocuri optime [ron]
Beneficii anuale stoc optim produs
valoare produs
valoare lunara stoc ron 2
valoare lunara comenzi ron 2
Variatia stocurilor vs.comenzi produs nr. 2
Numarul produsului din portofoliu 2
Stocuri optime lunare 2
Valoare produs [ron] 2
valoare lunara stocuri optime [ron] 2
valoare produs 2
Beneficii anuale stoc optim produs
valoare lunara stoc ron 3
valoare lunara comenzi ron 3
Variatia stocurilor vs.comenzi produs nr. 3
Numarul produsului din portofoliu 3
Stocuri optime lunare 3
Valoare produs [ron] 3

4. Case study of Optimisation the Company Stock

Total Sales Value	STOC
28,874	111
50,851	73
47,76	126
108,82	204
87,037	422
90,691	452
36,726	8
56,306	141
97,389	8
61,686	339
63,256	51
91,676	102
101,202	77
150,048	48
192,232	30
21,485	19
4,022	95
5,385	6
144,322	453
323,698	457
378,174	443
52,732	33
56,291	87
82,647	35
64,631	33
57,241	91
96,791	20
4,523	31
1,368	9
71,88	79
62,89	50
67,253	13
441	61
277	74

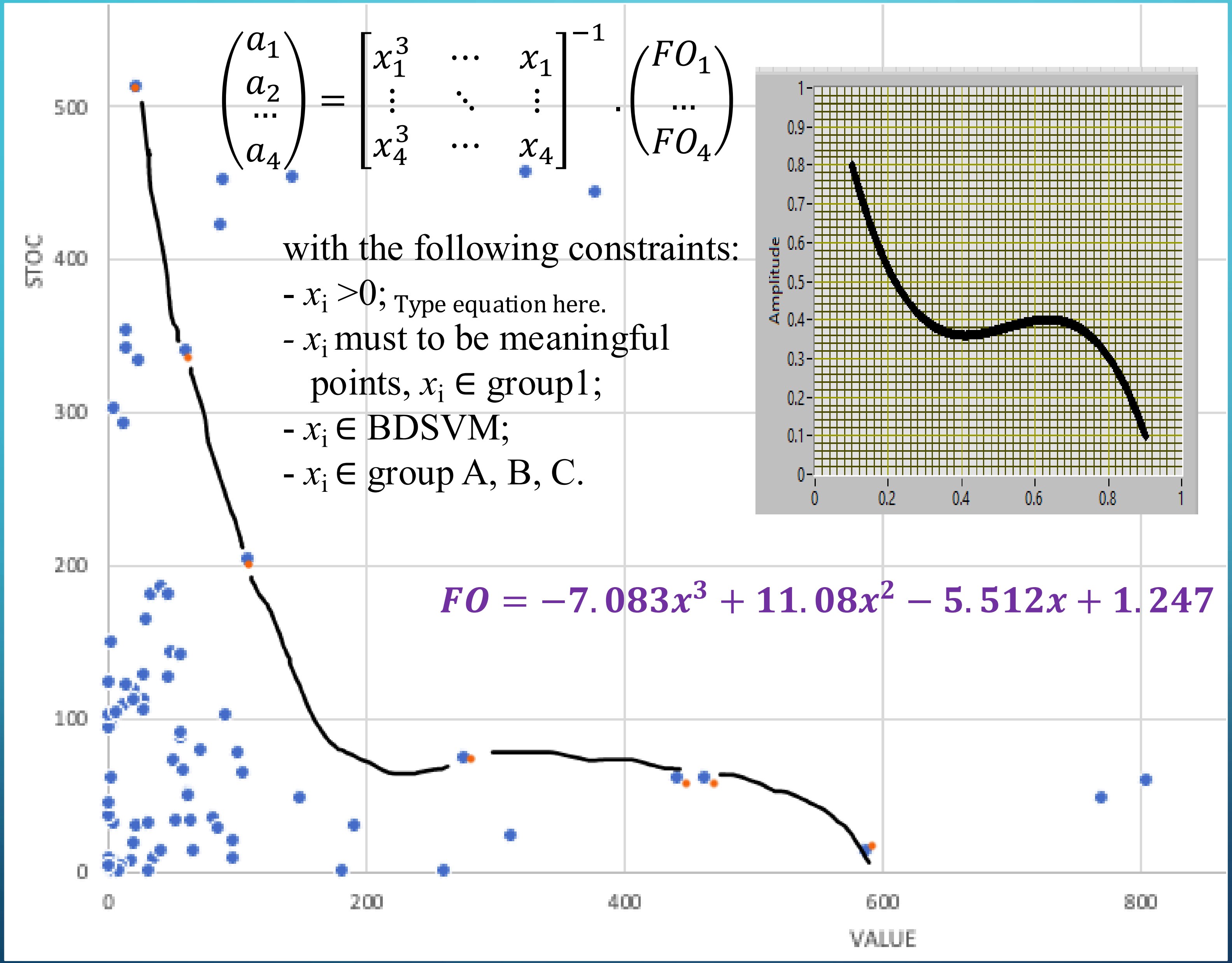


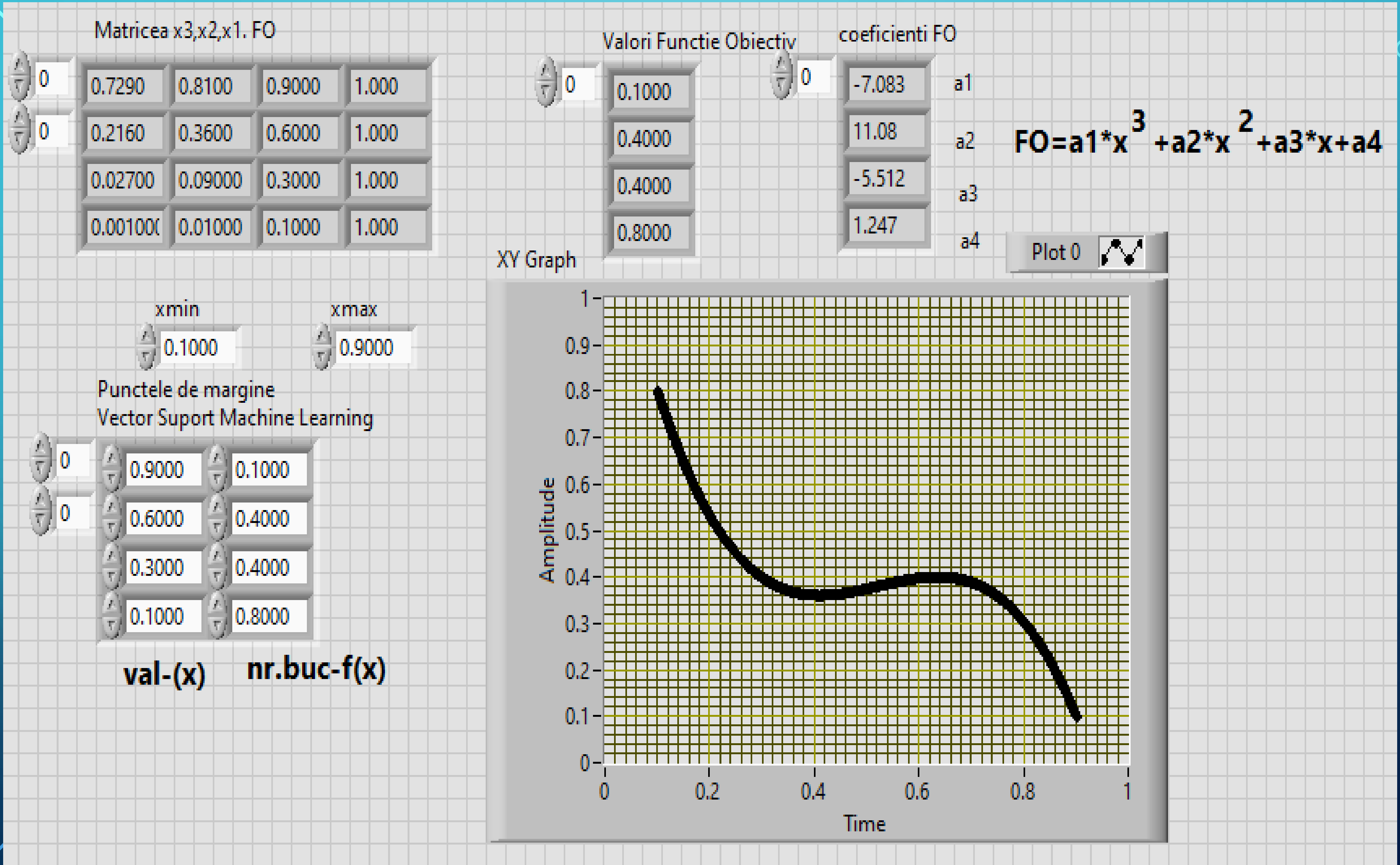
$$\begin{pmatrix} a_1 \\ a_2 \\ \cdots \\ a_4 \end{pmatrix} = \begin{bmatrix} x_1^3 & \cdots & x_1 \\ \vdots & \ddots & \vdots \\ x_4^3 & \cdots & x_4 \end{bmatrix}^{-1} \cdot \begin{pmatrix} FO_1 \\ \cdots \\ FO_4 \end{pmatrix}$$

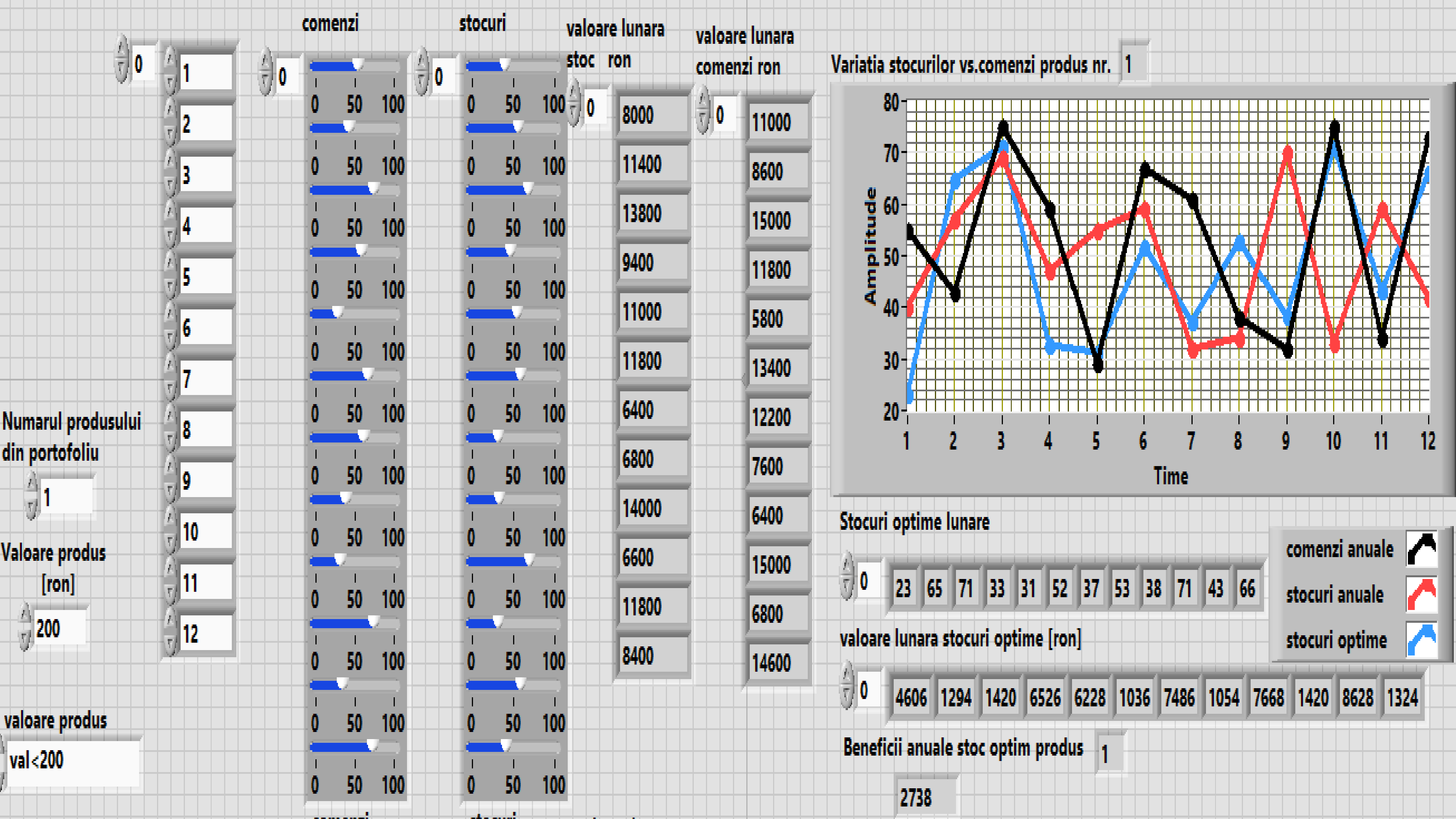
with the following constraints:

- $x_i > 0$; Type equation here.
- x_i must to be meaningful points, $x_i \in$ group1;
- $x_i \in$ BDSVM;
- $x_i \in$ group A, B, C.

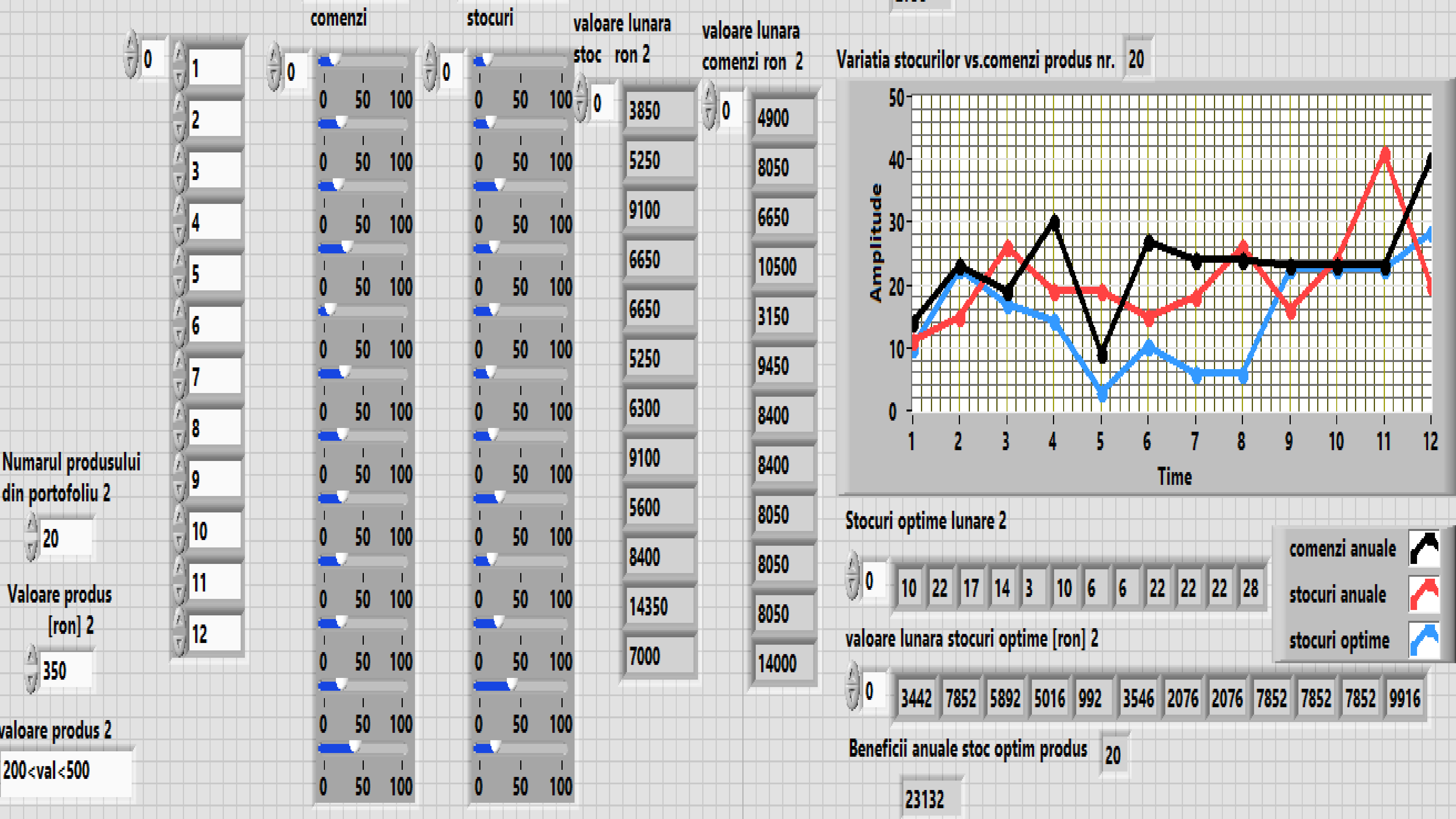
$$FO = -7.083x^3 + 11.08x^2 - 5.512x + 1.247$$




Matricea x3,x2,x1. FO
0
0
0.7290 0.8100 0.9000 1.000
0.2160 0.3600 0.6000 1.000
0.02700 0.09000 0.3000 1.000
0.00100(0.01000 0.1000 1.000
Valori Functie Obiectiv
0
0.1000
0.4000
0.4000
0.8000
coeficienti FO
0
-7.083 a1
11.08 a2
-5.512 a3
1.247 a4
FO=a1*x3 +a2*x2 +a3*x+a4
xmin
0.1000
xmax
0.9000
Punctele de margine
Vector Suport Machine Learning
0
0
0.9000 0.1000
0.6000 0.4000
0.3000 0.4000
0.1000 0.8000
val-(x) nr.buc-f(x)
XY Graph
Plot 0
Amplitude
Time
0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1
0 0.2 0.4 0.6 0.8 1



comenzi
stocuri
valoare lunara stoc ron
valoare lunara comenzi ron
Variatia stocurilor vs.comenzi produs nr. 1
1 2 3 4 5 6 7 8 9 10 11 12
0 50 100
8000 11400 13800 9400 11000 11800 6400 6800 14000 6600 11800 8400
11000 8600 15000 11800 5800 13400 12200 7600 6400 15000 6800 14600
Amplitude
80 70 60 50 40 30 20
Time
1 2 3 4 5 6 7 8 9 10 11 12
Numarul produsului din portofoliu
1
Valoare produs [ron]
200
valoare produs
val<200
Stocuri optime lunare
23 65 71 33 31 52 37 53 38 71 43 66
comenzi anuale
stocuri anuale
stocuri optime
valoare lunara stocuri optime [ron]
4606 1294 1420 6526 6228 1036 7486 1054 7668 1420 8628 1324
Beneficii anuale stoc optim produs 1
2738


comenzi
stocuri
valoare lunara stoc ron 2
valoare lunara comenzi ron 2
Variatia stocurilor vs.comenzi produs nr. 20
0
1
2
3
4
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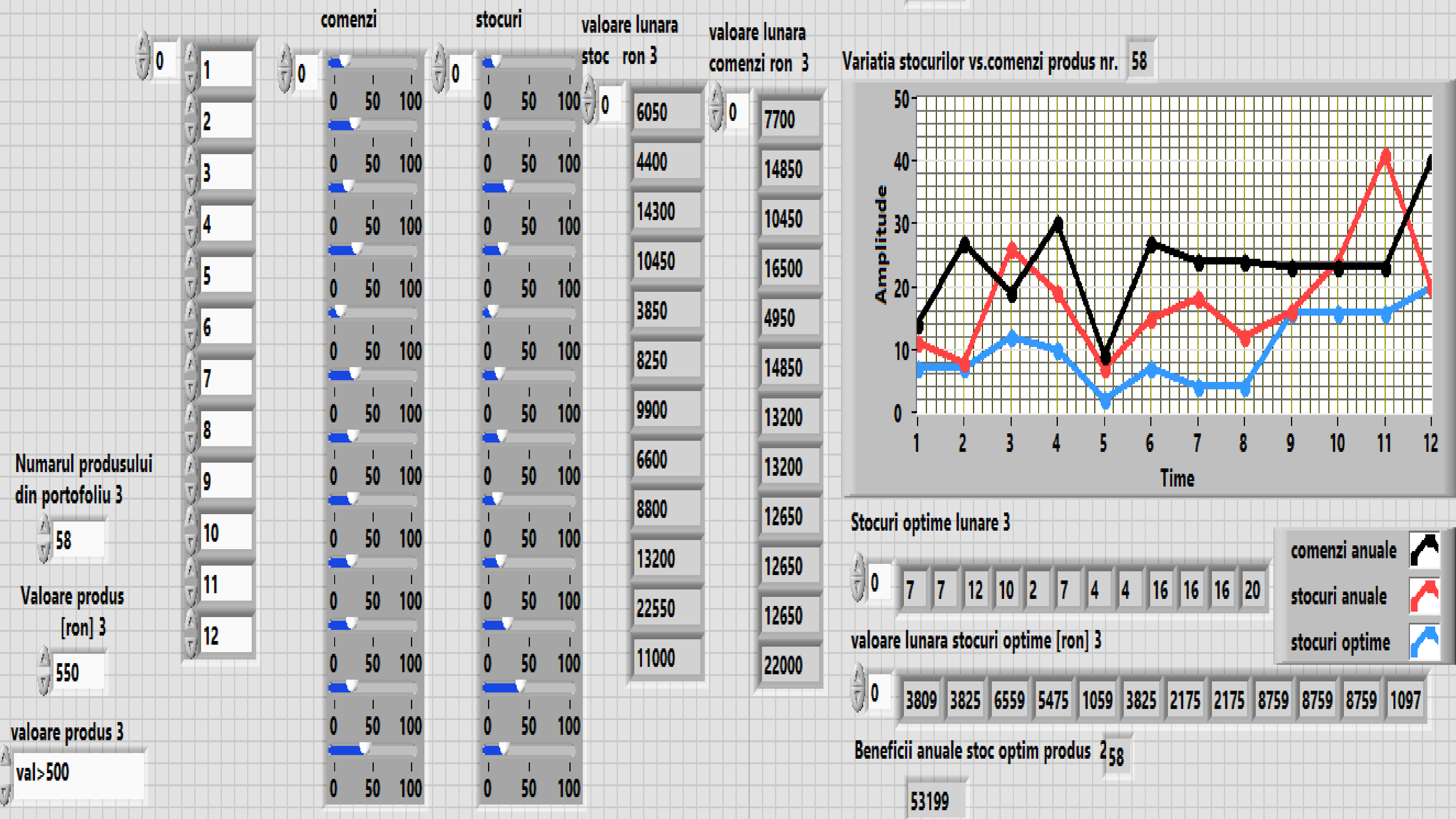
6
7
8
9
10
11
12
0 50 100
3850
5250
9100
6650
6650
5250
6300
9100
5600
8400
14350
7000
4900
8050
6650
10500
3150
9450
8400
8400
8050
8050
8050
14000
Amplitude
Time
50
40
30
20
10
0
1 2 3 4 5 6 7 8 9 10 11 12
Numarul produsului din portofoliu 2
20
Valoare produs [ron] 2
350
valoare produs 2
200<val<500
Stocuri optime lunare 2
0
10 22 17 14 3 10 6 6 22 22 22 28
comenzi anuale
stocuri anuale
stocuri optime
valoare lunara stocuri optime [ron] 2
0
3442 7852 5892 5016 992 3546 2076 2076 7852 7852 7852 9916
Beneficii anuale stoc optim produs
20
23132



comenzi
stocuri
valoare lunara stoc ron 3
valoare lunara comenzi ron 3
Variatia stocurilor vs.comenzi produs nr. 58
0
1
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3
4
5
6
7
8
9
10
11
12
0 50 100
6050
4400
14300
10450
3850
8250
9900
6600
8800
13200
22550
11000
7700
14850
10450
16500
4950
14850
13200
13200
12650
12650
12650
22000
Amplitude
50
40
30
20
10
0
1 2 3 4 5 6 7 8 9 10 11 12
Time
Numarul produsului din portofoliu 3
58
Valoare produs [ron] 3
550
valoare produs 3
val>500
Stocuri optime lunare 3
7 7 12 10 2 7 4 4 16 16 16 20
comenzi anuale
stocuri anuale
stocuri optime
valoare lunara stocuri optime [ron] 3
3809 3825 6559 5475 1059 3825 2175 2175 8759 8759 8759 1097
Beneficii anuale stoc optim produs 2 58
53199

5. Application of the DBSVM

Monitoring the wear trend in wind turbines by tracking the Fourier vibration spectrum and base density support vector machine

Claudiu Bisu [1], Adrian Olaru [1*], Serban Olaru [2], Adrian Alexei [2], Niculae Mihai [3], Haleema Ushaq[1]

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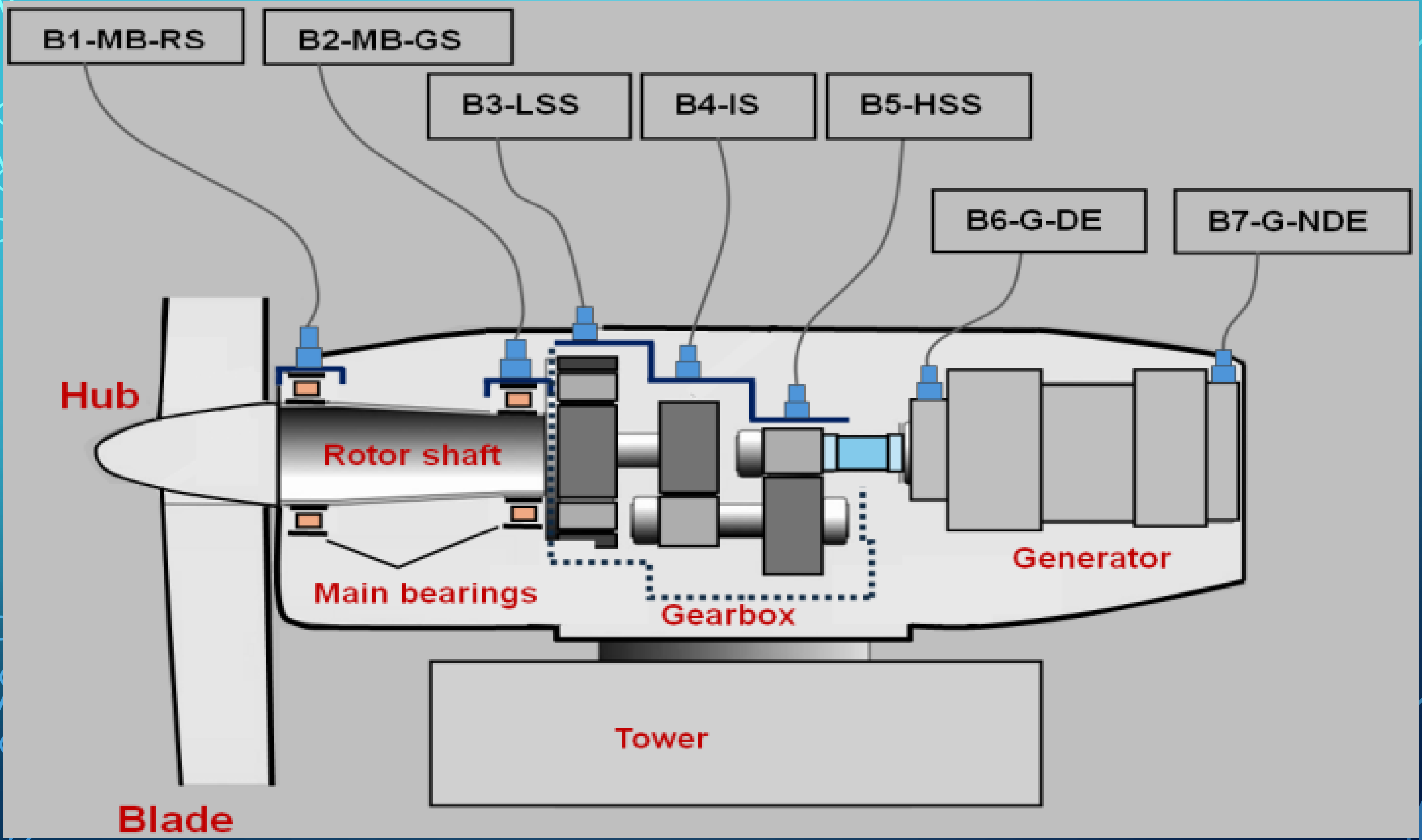
Correspondence: aolaru_51@ymail.com; Tel.: +40723852628;



B1-MB-RS
B2-MB-GS
B3-LSS
B4-IS
B5-HSS
B6-G-DE
B7-G-NDE
Hub
Rotor shaft
Main bearings
Gearbox
Generator
Tower
Blade

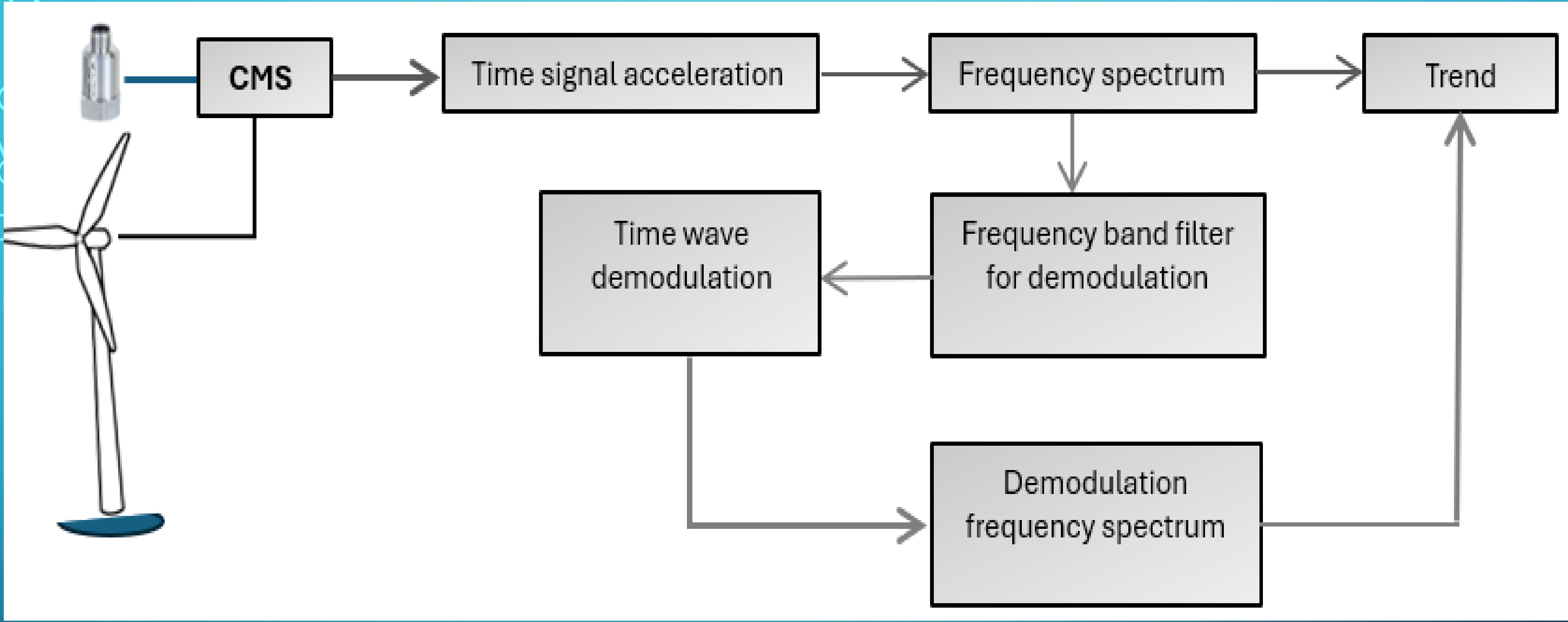


Figure 3. Synopsis of data acquisition and signal processing.

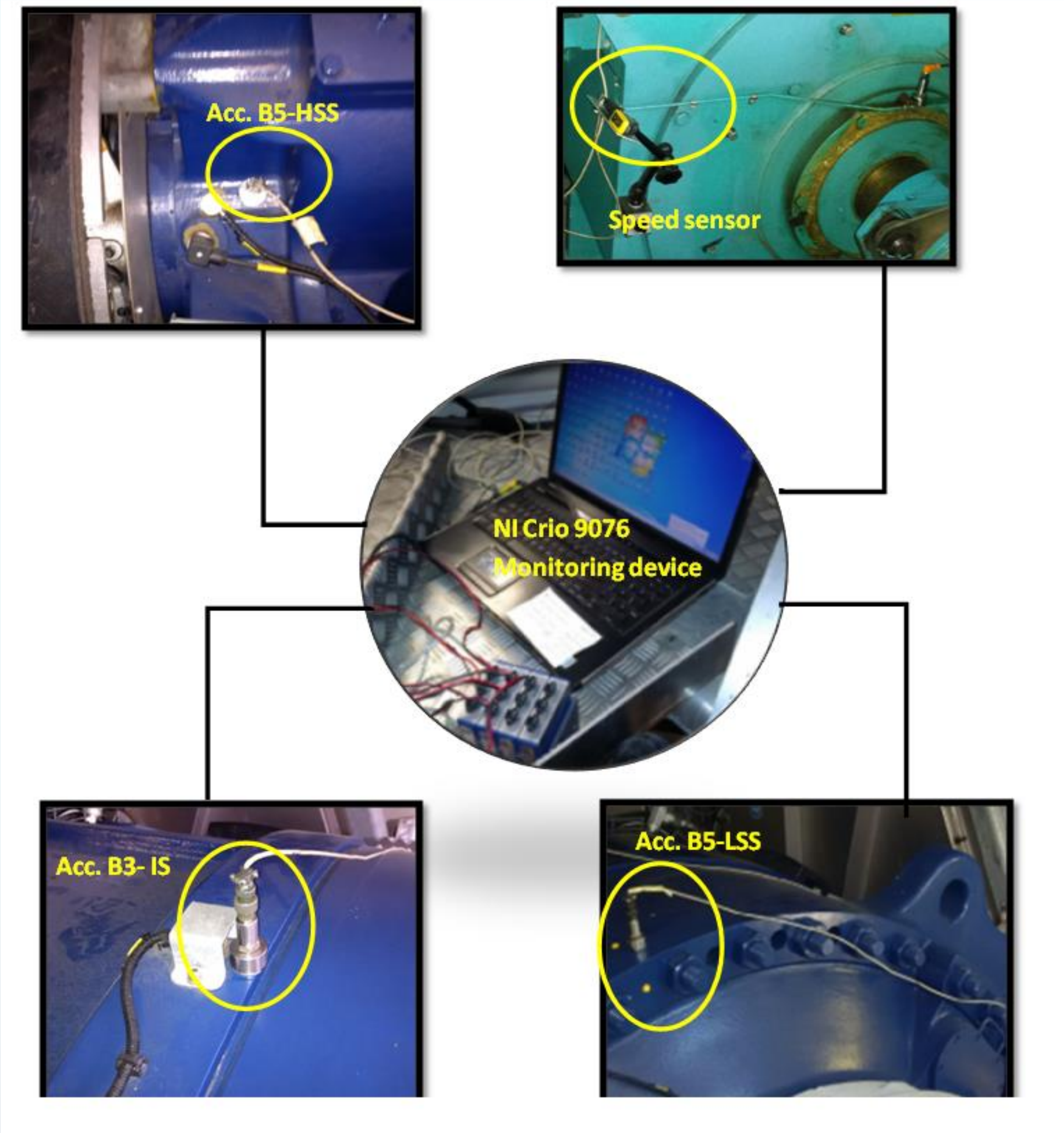
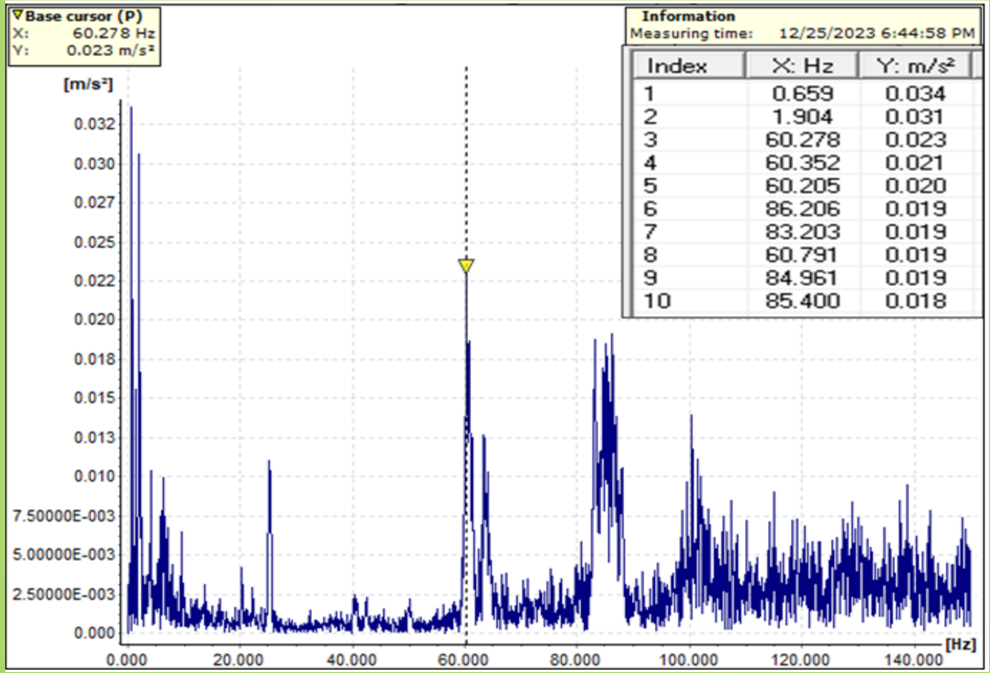


Figure 5. Vibration monitoring devices.

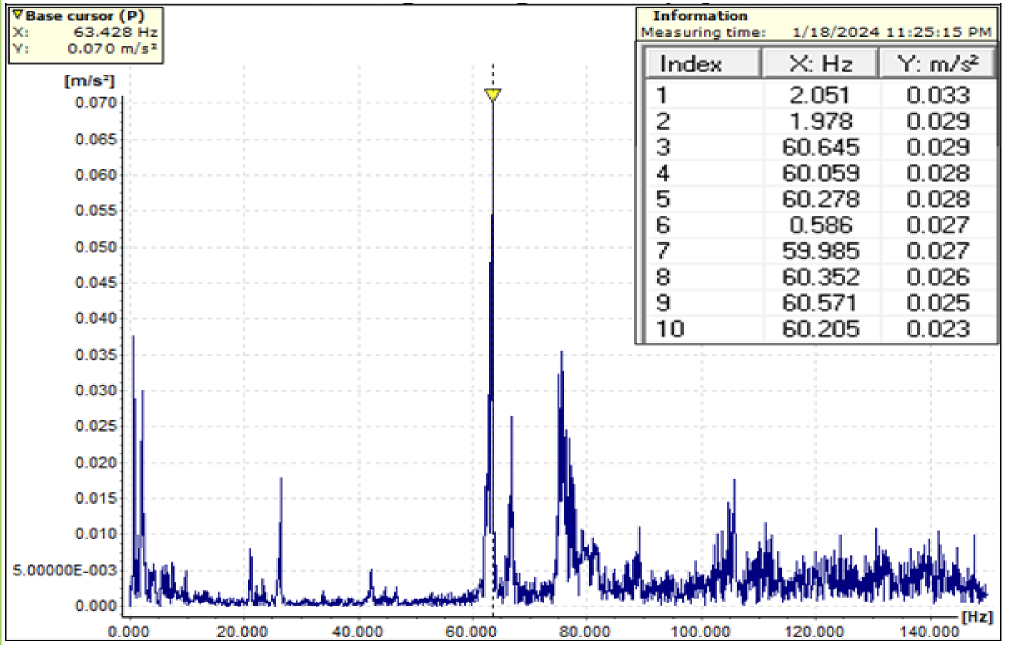
$$FO = a_1 * x^5 + a_2 * x^4 + a_3 * x^3 + a_4 * x^2 + a_5 * x + a_6 \tag{14}$$

where a_i will be determined by using the matrix equation:

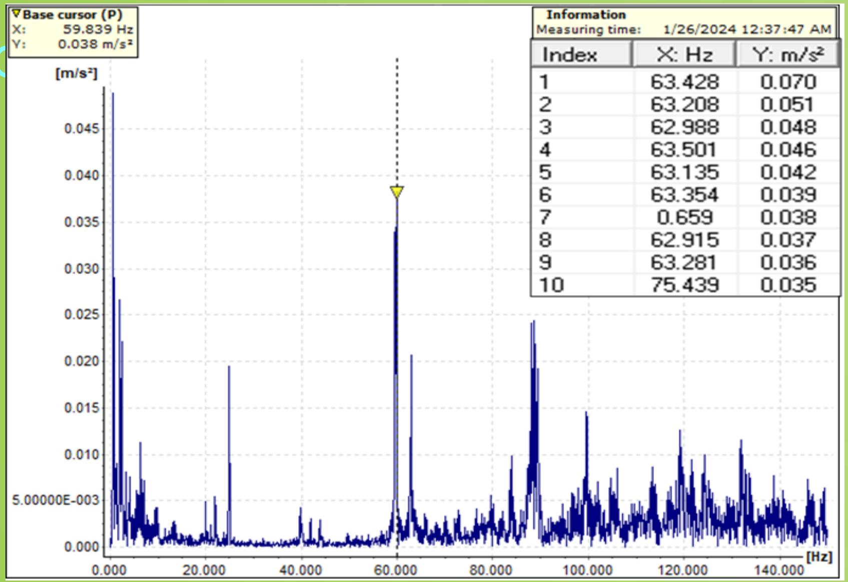
$$\begin{pmatrix} \boldsymbol{a_1} \\ \boldsymbol{a_2} \\ \cdots \\ \boldsymbol{a_6} \end{pmatrix} = \left\{ \begin{bmatrix} \boldsymbol{x_1^5} & \cdots & \boldsymbol{x_1} & \boldsymbol{1} \\ \vdots & \ddots & \vdots & \\ \boldsymbol{x_5^5} & \cdots & \boldsymbol{x_5} & \boldsymbol{1} \end{bmatrix} \begin{bmatrix} \boldsymbol{x_1^5} & \cdots & \boldsymbol{x_1} & \boldsymbol{1} \\ \vdots & \ddots & \vdots & \\ \boldsymbol{x_5^5} & \cdots & \boldsymbol{x_5} & \boldsymbol{1} \end{bmatrix}^{\boldsymbol{T}} \right\}^{\boldsymbol{-1}} \begin{pmatrix} \boldsymbol{FO_1} \\ \cdots \\ \boldsymbol{FO_5} \end{pmatrix} \tag{15}$$



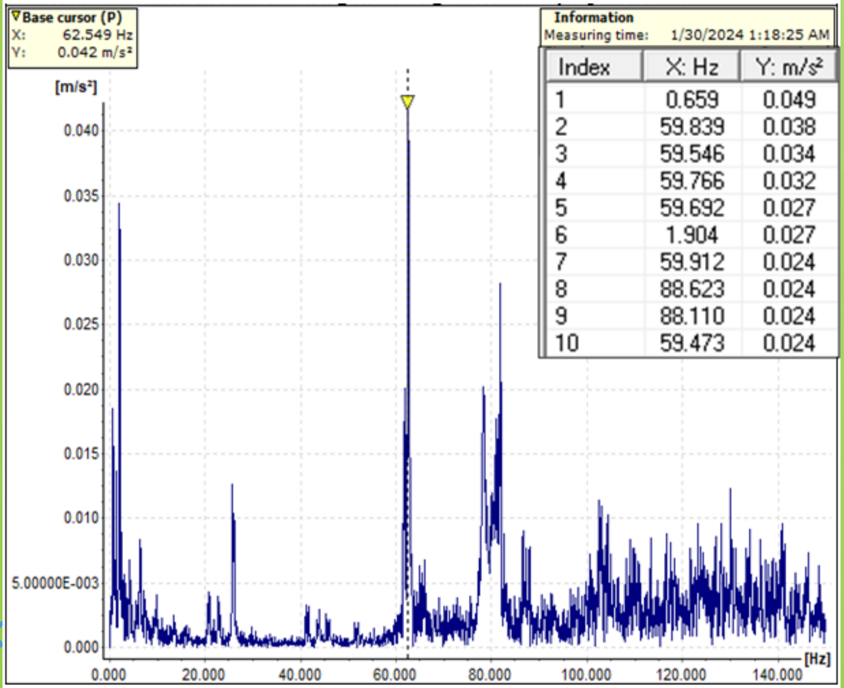
a- Fourier spectrum at 1514RPM and 1037.4kW on 25/12/2023, in an upwind position



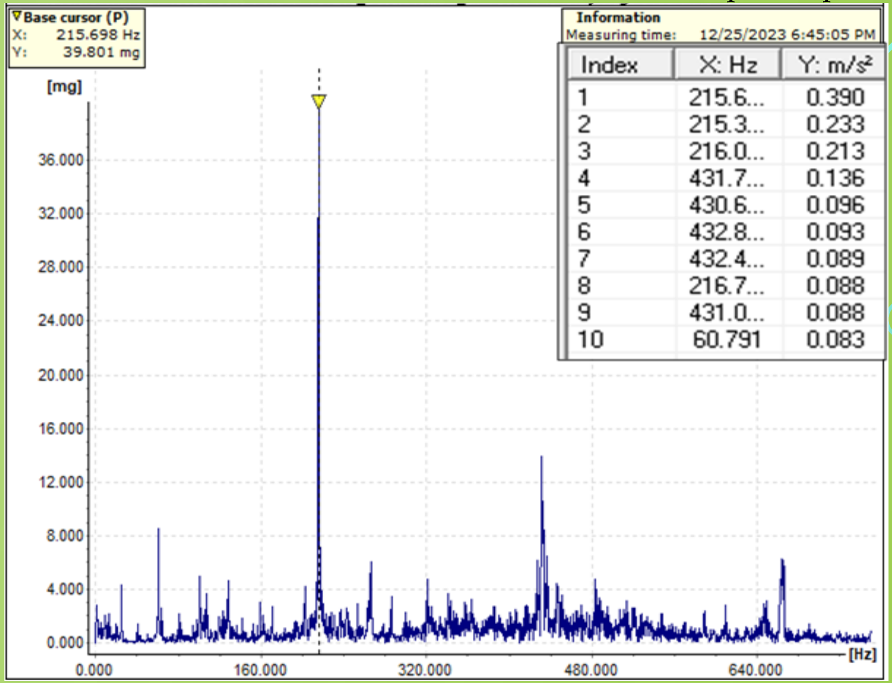
b- Fourier spectrum at 1577RPM and 1169.4kW on 18/01/2024, in an upwind position.



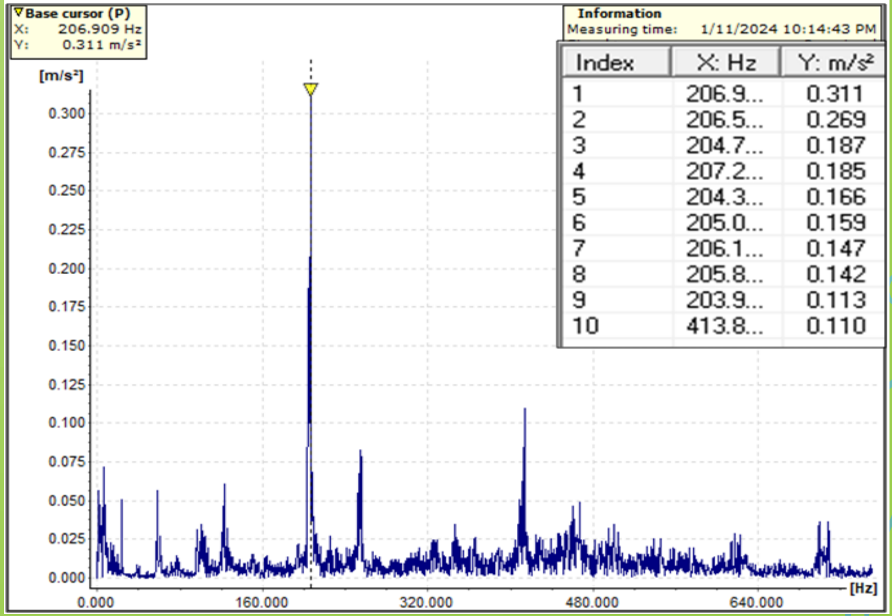
c- Fourier spectrum at 1492RPM and 1027.6kW on 26/01/2024, in an upwind position.



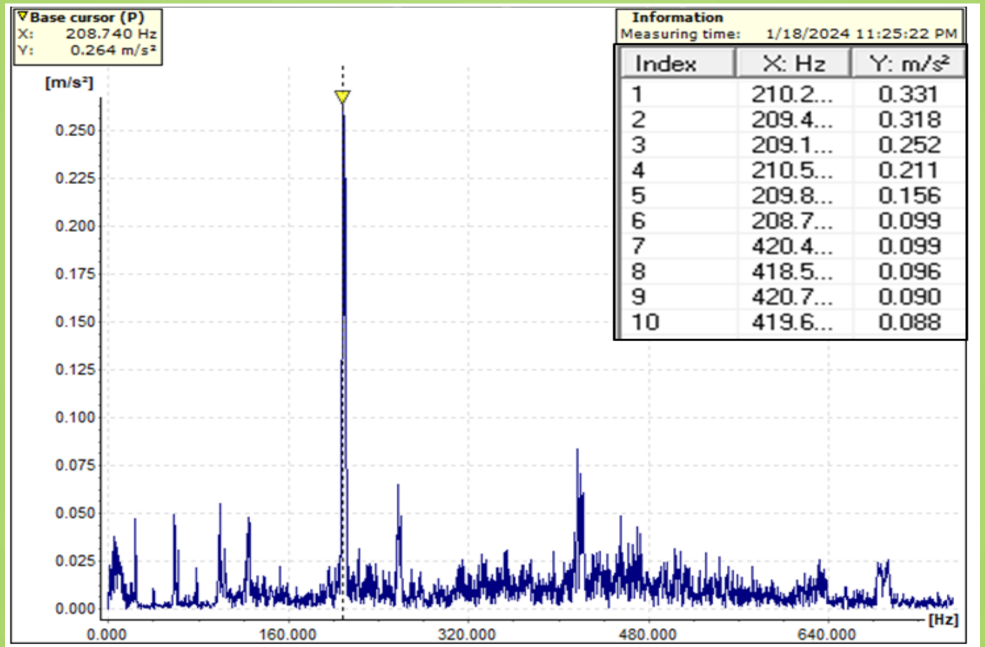
d- Fourier spectrum at 1552RPM and 1158kW, om 30/01/2024 in an upwind position.



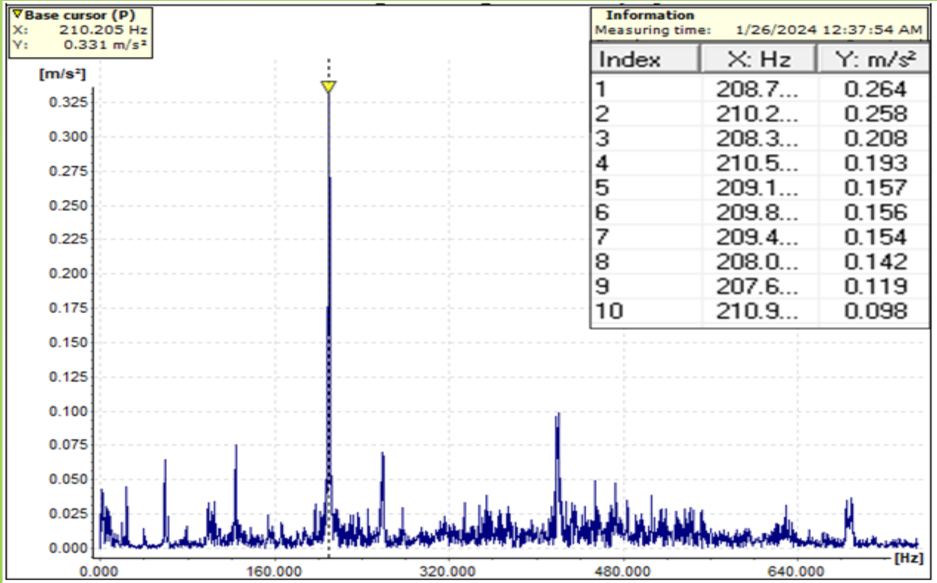
e- Fourier spectrum at 1523RPM and 1054kW on 25/12/2023, in a downwind position.



f- Fourier spectrum at 1455RPM and 971.4kW on 11/01/2024, in a downwind position.



g- Fourier spectrum at 1471RPM and 982kW on 18/01/2024, in a downwind position.



h- Fourier spectrum at 1481 RPM and 1006.5kW on 26/01/2024, in a downwind position.

Figure 15. Fourier spectrum from data acquisition between December 2023 to February 2024, in an upwind and downwind position of the sensors in the gearbox of WT.

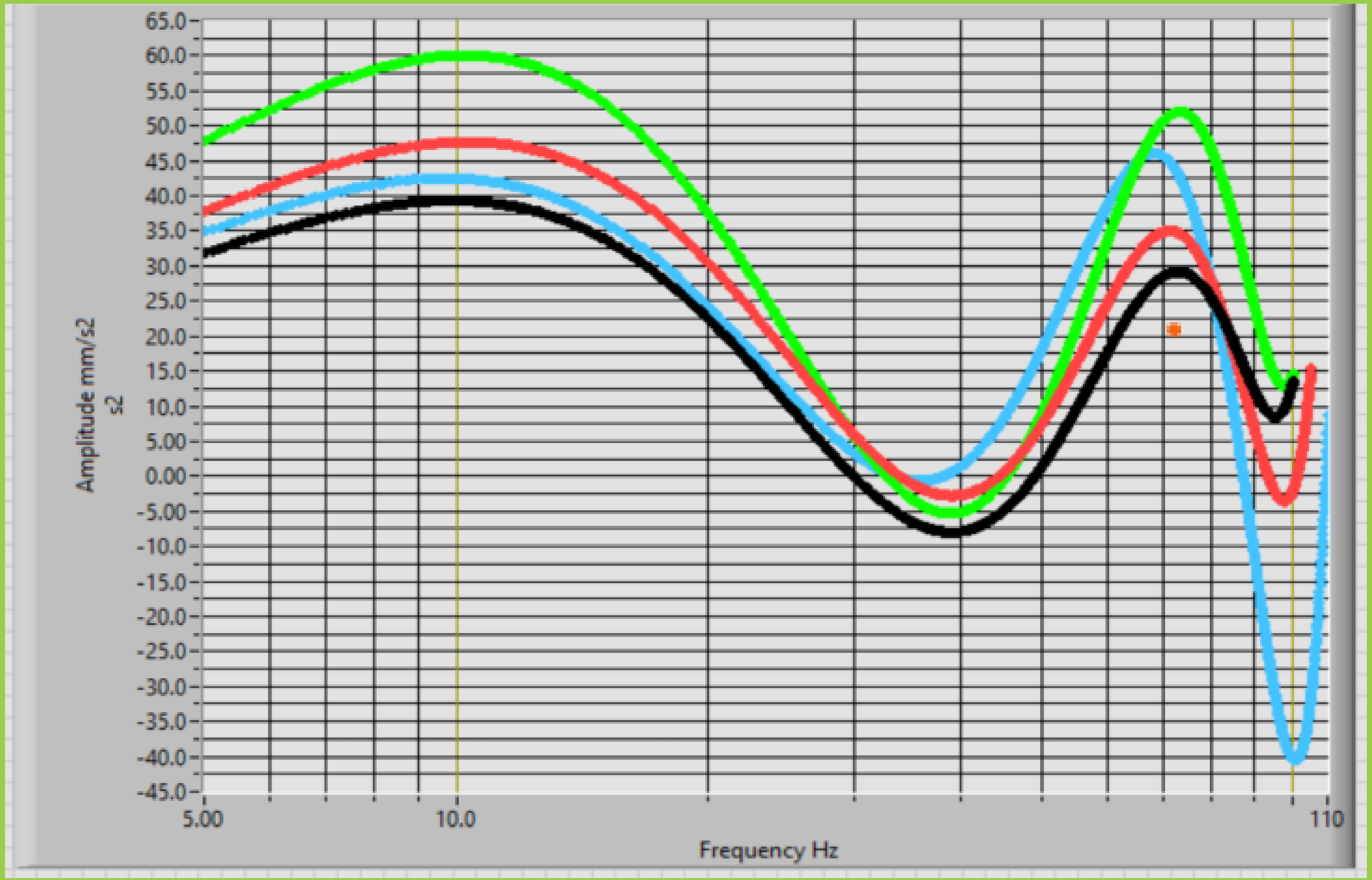


Figure 16. Objective functions (FO_i) for all four selected acquisition data in the upwind sensor position.

! " = 6.64*! − 0.00017*" + 0.017*# − 0.0668*$ + 8.84* + 2.473

" = 7.44*! − 0.0002*" + 0.019*# − 0.762*$ + 10.368* + 2.921

" = 9.291*! − 0.00025*" + 0.00246*# − 0.969*$ + 13.1305* + 3.664

" = 8.28*! − 0.00022*" + 0.02*# − 0.762*$ + 9.781* + 2.735

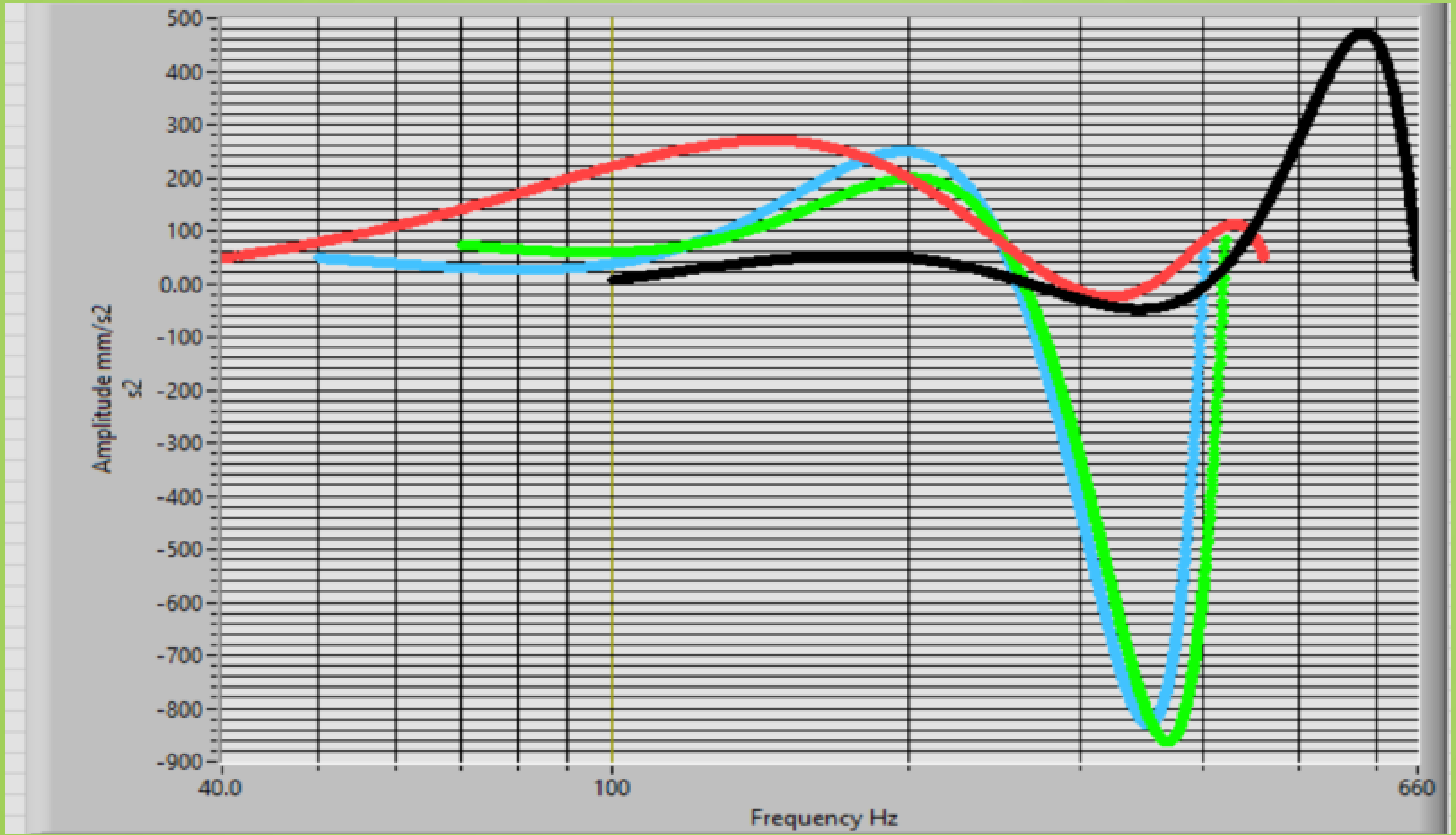


Figure 18. Objective functions (FO_i) for all four selected acquisition data in a downwind sensor position.

$$FO = -3.745x^5 + 5.323x^4 - 0.00025x^3 + 0.045x^2 - 2.447x - 0.054$$
$$FO = -1.494x^5 + 1.68x^4 - 0.00062x^3 + 0.08x^2 - 1.056x - 0.04$$
$$FO = 5.902x^5 - 5.157x^4 + 0.00014x^3 - 0.171x^2 + 7.366x + 0.25$$
$$FO = 7.391x^5 - 6.068x^4 + 0.00161x^3 - 0.161x^2 + 5.767x + 0.234$$

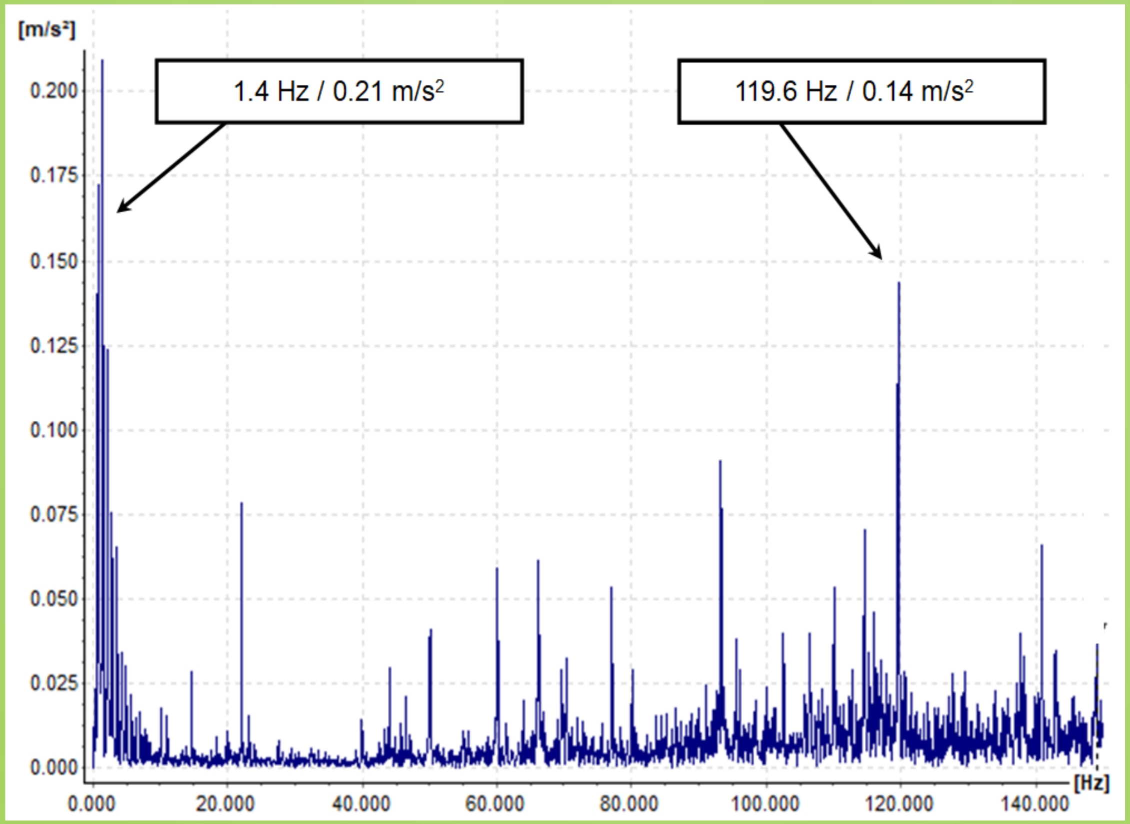


Figure 20. The frequency spectrum at LSS poistion in the case of gearbox defect.

The trend functions are the following:

- for the low frequency in the upwind position

$$FO = 5.6234x^{!} - 205.21x^{"} + 2779.11x^{\#} - 16307.64x^{\$} + 32142.12x + 20071.2$$

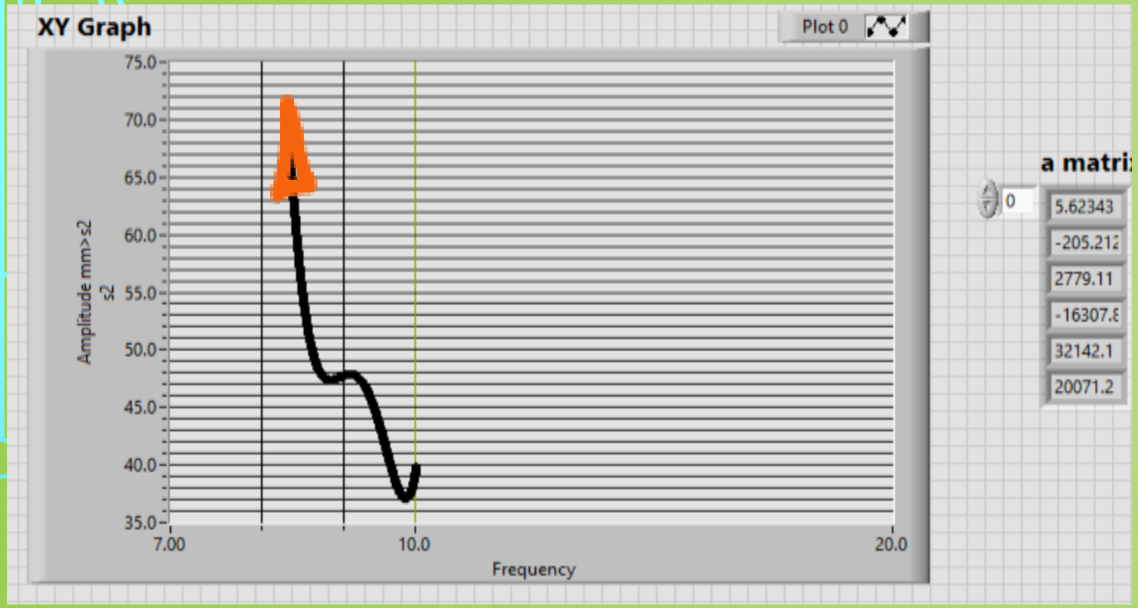
- for high frequency in the upwind position

$$FO = 4.306x^{!} - 0.0096x^{"} + 0.7267x^{\#} - 18.112x^{\$} - 0.9755x - 0.0328$$

- for high frequency in the downwind position

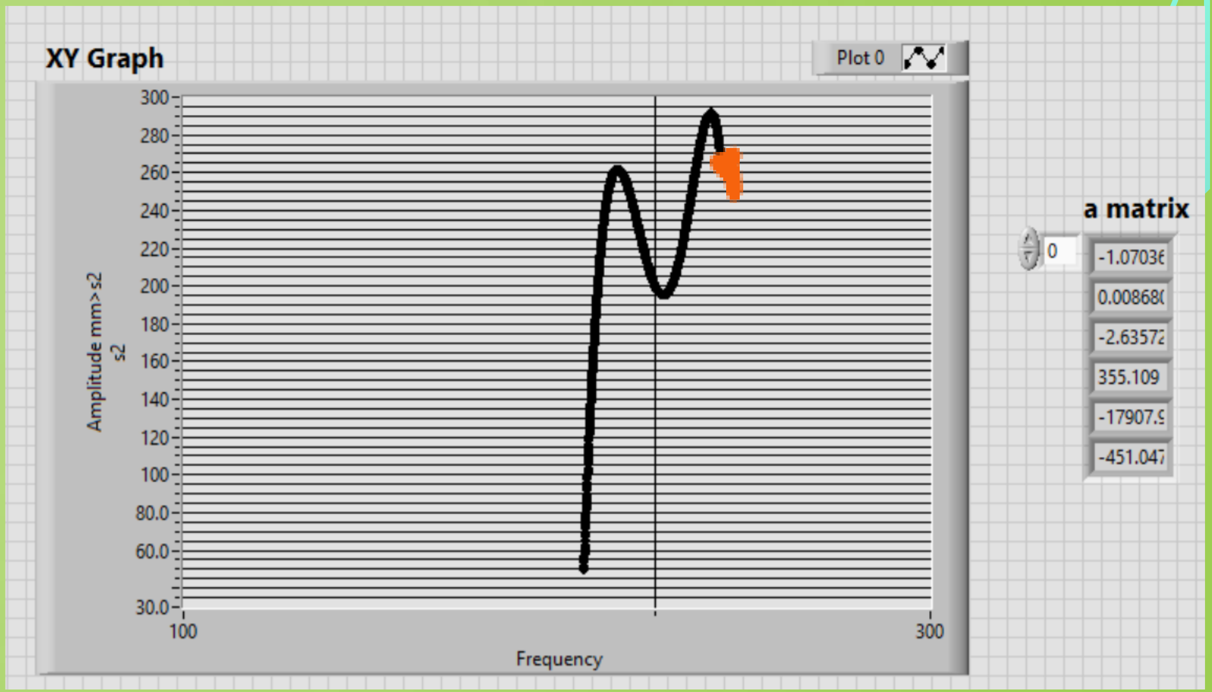
$$FO = -1.0703x^{!} + 0.0086803x^{"} - 2.6357x^{\#} + 355.109x^{\$} - 17907.9x - 451.047$$

$(Magnitude, frequency)_{\%\&' (') (*+, - \%\& 0' *_{! " \# \$\%\&) \&(\# \%\# \$\%\&}} \in FO_{(*012_{! " \# \$\%\&) \&(\# \%\# \$\%\&}}$



a- Trend of the *FO* in the upwind position of the gearbox sensor in a low frequency.

b- Trend of the *FO* in the upwind position of the gearbox sensor in a high frequency.



c- trend of the *FO* in the downwind position of the gearbox sensor.

Figure 22. The trend of the magnitude- -frequency points from the *FO*.

6. Conclusions

- In the paper was shown one complex method to establish the Base Density Support Vector Machine (BDSVM) for one case to optimise the company stock;
- The results could be used by the company what was analysed, but also could be apply to many others companies;
- In the analyse was used assisted research with some proper virtual LabView instrumentations that could cover the theory to optimise BDSVM;
- The shown method, the results and assisted LabView instrumentation open the way to optimize the stocks, reduce the financial effort of the companies and assure one optimal repartition of the products for each month, during the year.

7. Future work

The proposed algorithm can be improved with new conditions so that the obtained results will be better filtered and the convergence of the applied neural networks will be better ensured.

8. References

1. Chih Chung Chang and Chih Jen Lin. LIBSVM: a library for support vector machines. *ACM Transactions on Intelligent Systems and Technology* 2, 27:1-27:27 (2011). Software available at http://www.csie.ntu.edu.tw/~cjlin/libsvm.
2. Hsu, C.-W., C.-C. Chang, and C.-J. Lin. (2010). A practical guide to support vector classification. National Taiwan University. https://www.csie.ntu.edu.tw/~cjlin/papers/guide/guide.pdf.
3. Wu, T.-F., C.-J. Lin, and R. C. Weng. (2004). Probability estimates for multi-class classification by pairwise coupling. Journal of Machine Learning Research, 5:975-1005, https://www.csie.ntu.edu.tw /~cjlin /papers/svmprob/svmprob.pdf.
4. Hastie, T., Tibshirani, R., and Friedman, J. (2001) The Elements of Statistical Learning. Springer Verlag, New York.
5. Duda, R. O., Hart, P. E., and Stork, D. G. (2000) Pattern Classification (2nd Edition). Wiley-Interscience, New York.
6. McLachlan, G. J. (2004) Discriminant Analysis and Statistical Pattern Recognition. Wiley-Interscience, New York.
7. V. N. Vapnik, The Nature of Statistical Learning Theory, Springer 2000.
8. V. Kecman, Learning and Soft Computing, Support Vector Machines, Neural Networks, and Fuzzy Logic Models, The MIT Press 2001.
9. Y.Dodge,TheConciseEncyclopediaofStatistics,Springer2008.
10. Z. Nazari, D. Kang, and H. Endo, Density Based Support Vector Machines, The 29th International Technical Conference on Circuits/Systems, Computers and Communications (ITC-CSCC), pp.1-3, 2014.
11. El Moutaouakil K, El Ouissari A, Olaru A, Palade V, Ciorei M. OPT-RNN-DBSVM: OPTimal Recurrent Neural Network and Density-Based Support Vector Machine. *Mathematics*. 2023; 11(16):3555. https://doi.org/10.3390/math11163555.
12. Variance-covariance matrix- GeeksforGeeks.html
13. https://www.netsuite.com/portal/resource/articles/inventory-management/abc-inventory-analysis.shtml.

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