TENSION AND DEFORMATION IN THE VALVE'S OBTURATORS

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1. CALCULUS METHODS

Analysing the tensions and efforts condition to the flat of the duble decker cock, by the finite element method, in [1] is shown that eccentric situation, by function ability considerations, of the spindle axe from the cock disk center has a inessential influence on the tensions and efforts condition. On this observation bases the authors propose the static calculus of the duble decker cock (fig.1.) by assimilation it with a cadre plan with displacement nods (fig.2,b), the length of the bars being resulted from the constant maintenance, on the respective length, of the stagnation momentum (fig.2,a).

The exterior action, derived from the hydrostatic pressure uniform distributed on the cock disk, is focused in nods through the afferent focused forces. Admitting that in the plan of this forces are situated and the fulcrums from spindles straightforwardly, results the possibility of making a plan calculus.

Looking the cadre bars so defined as embedded bars in nods finite element, the problem solution can be leaded in the spirit of displacement method, preferred to the efforts method for the advantages it has regarding automation in solving the problem [2]. The global characteristic of the finite elements are presented through their tenseness, regrouped in their tenseness matrix $[k]_e$ as namely: this matrix elements being defined countenance a reference local system x, y (fig.3).

$$[k]_e = \begin{bmatrix} \frac{EA}{l} & 0 & 0 & -\frac{EA}{l} & 0 & 0 \\ 0 & \frac{12EI}{l^3} & \frac{6EI}{l^2} & 0 & -\frac{12EI}{l^3} & \frac{6EI}{l^2} \\ 0 & \frac{6EI}{l^2} & \frac{4EI}{l} & 0 & -\frac{6EI}{l^2} & \frac{2EI}{l} \\ -\frac{EA}{l} & 0 & 0 & \frac{EA}{l} & 0 & 0 \\ 0 & -\frac{12EI}{l^3} & -\frac{6EI}{l^2} & 0 & \frac{12EI}{l^3} & -\frac{6EI}{l^2} \\ 0 & \frac{6EI}{l^2} & \frac{2EI}{l} & 0 & -\frac{6EI}{l^2} & \frac{4EI}{l} \end{bmatrix} \qquad (1)$$

Assembling matrix $[k]_e$ in the tenseness matrix for whole structure [K], on a side, and composing exterior loadings vector {F}, on the other side, results, after elimination of the rigid corps liberty pitches, the system of linear algebra equations, whom unknowns are the U, V, ϕ nods displacements, of the reported nods to the global XOY axe system. The assemblage automation consists in the placement of the $[k]_e$ matrix elements in the tenseness matrix for whole structure [K] and addition of the appropriate elements.

To resolve the generate equation system, we can appeal to math calculus specialised programmes (solution algorithm), if the equation system dimension allows this thing.

Knowing the bars tags displacement vector to the local system and the rotation matrix $[R_c]$ results matrix $\{\delta\}_e$, relations (2) and (3)

$$\{\delta\}_e = \begin{Bmatrix} u_j \\ v_j \\ \varphi_j \\ u_k \\ v_k \\ \varphi_k \end{Bmatrix} \qquad (2)$$

$$[R]_e = \begin{bmatrix} \cos\alpha & \sin\alpha & 0 & 0 & 0 & 0 \\ -\sin\alpha & \cos\alpha & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & \cos\alpha & \sin\alpha & 0 \\ 0 & 0 & 0 & -\sin\alpha & \cos\alpha & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 \end{bmatrix}$$

$$\{\delta\}_e = [R]_e \cdot \{\Delta\}_e \qquad (3)$$

and the bars tags stress, relation (4) :

$$\{s\} = \begin{Bmatrix} N_j \\ T_j \\ M_j \\ N_k \\ T_k \\ M_k \end{Bmatrix} = \{k\}_e \cdot \{\delta\}_e \qquad (4)$$

In the strength calculus for the duble decker cock significant are axial force N and the moment of inflection M with whom can be calculated normal tension: $\sigma = N / A \pm M / W$ in the extreme fibers. Normal tensions medium value,

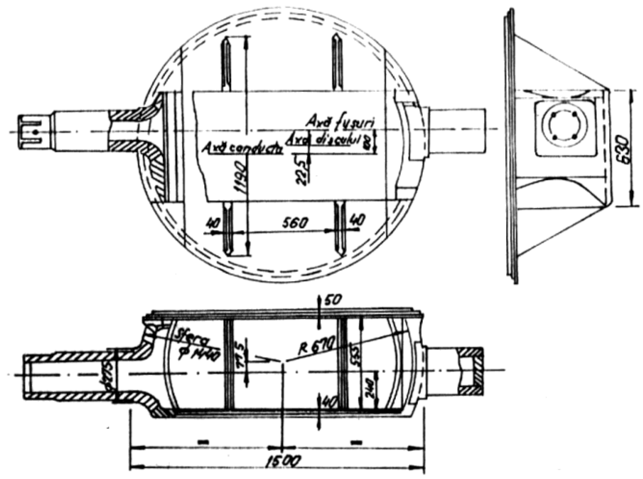

Figure 1.

calculated in upriver fiber concordant to the cock disk, and is represented in fig.2. The inscribed values in parenthesis are obtained with the finite element method [1]. On other hand, by knowing the displacements of the cadre nods, represented in fig.4. is offered the possibility to pursue the deformations effect above the garnish tightness, respectively the fastener. The cock tenseness control, rarely made in the simplified calculation lead on the simple incumbent beam scheme [3], complete the strength calculation and give the opportunity to a better knowledge of the cock behaviour under hydrostatic pressure action.

The automatic calculation program made by the authors is dimensioned to be able to resolve cadres with at most 15 bars and 15 nods (from which at most 5 nods can be incumbent), adequate values in decreeing of a butterfly cock. The cadre bars position can be certain, which permit and cock analysis having leaning diaphragm.

Programme exploitation necessitate a reduce volume of dates, namely:

- information regarding bars number, nods number, incumbent nods and loaded nods of the cadre;
- nods coordinate in a right reference system;
- structure topology (linked nods order number for each bar of the cadre);
- incumbent nods order number and the type of underpin: fix embedded, mobile embedded after X or Y, fix articulate, simple incumbent;
- area and stagnation moment of the cadre bars;
- loaded nods order number and F_x, F_y, M components of the exterior concentrate action in nods.

Knowing these dates, the program generates the linear algebra equations system with U, V, Ø unknowns, resolves the system and calculates the request at bars tags. On the printer it prints first initial dates, then calculations results.

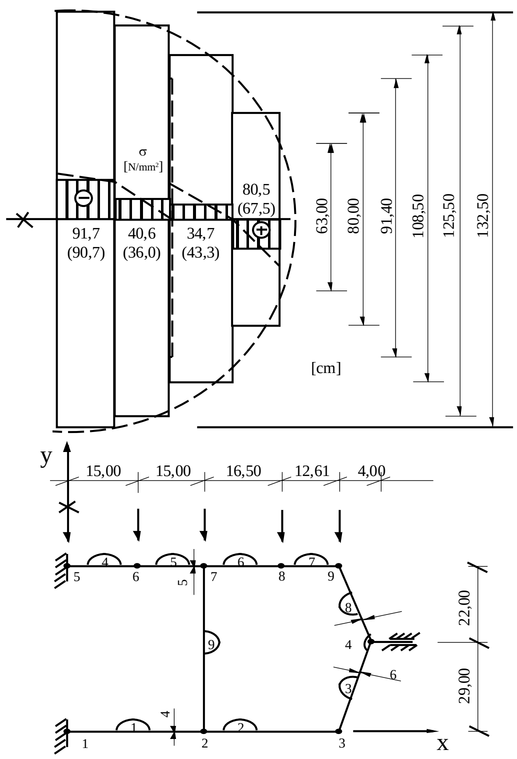

Figure 2.

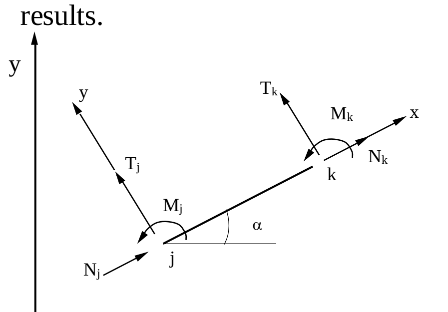

Figura 3.

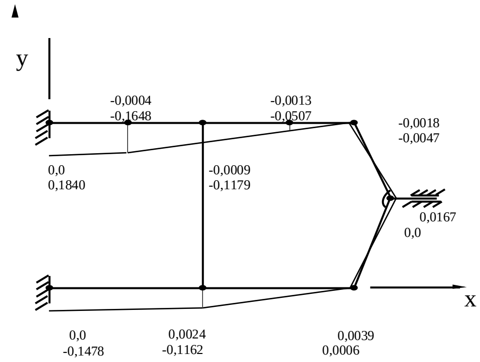

Figure 4.

CONCLUSIONS

On detailed knowledge of the tensions and deformations field from the cock flap, as well on the observations presented in the first chapter of this study, it could be elaborated a new model of the butterfly cock disk, considered a cadre with movable nods. For this, it was conceived a calculation program named " CLAPET A" [THE FLAP], of a very high practical utility because permits to optimization study of the constructive solutions, the running time of the program being acceptable from practical point of vue.

Comparing theoretical results obtained with the finite element method [1] with the ones presented in the present study we can say that the calculated maximum tensions value in the central section of the duble decker butterfly cock, as the ones of deformations don't exceed a 2% percent digression.

Bibliography

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