PROPOSALS FOR ENHANCING CONSTRUCTIVE PARAMETERS OF TRANSPORT BY CONVEYOR BELT

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Abstract: The paper proposes the improvement of technological parameters for band conveyors by the optimization of conveyance report of the movement between the electric motor and the drive drum. In order to determine the optimum capacity of band conveyers we start from the general equation, the vee profile of the material section on band is imposed, its equation is being determined, the bedding coefficient is being found out and its relation is further obtained for a maximum section of the material. Starting from the mathematical model the optimization of vee diagram conveyer drive is being analyzed.

1. FORMULATION OF OPTIMIZATION PROBLEM

Optimization problem consists in determining the transmission mechanism for transmitting that report to ensure maximum value for acceleration and deceleration, ie to ensure maximum energy transfer mechanism working shaft, or lead to minimize the working time for a fixed amount of working mechanism of movement.

2. OPTIMIZING THE TRANSMISSION

The condition of minimum required working time resulting from the equation obtained by canceling the derivative criterion function compared with the conveyance report:

$$\frac{\partial t_l}{\partial i} = 0 \tag{1}$$

which leads to the equation:

$$2\,i\,J_M\left[i^3 M_P M_f + i^2 M_S\left(M_P - M_f\right) - i\,M_S{}^2\right] + \left(i^2 J_M + J_L\right)\left(-i^2 M_P M_f - M_S{}^2\right) = 0 \tag{2}$$

Introducing the notations:

$$\frac{M_P}{M_S} = p; \quad \frac{M_f}{M_S} = f; \quad \frac{J_M}{J_L} = m_J \tag{3}$$

se obține forma finală a ecuației:

$$m_J pfi^4 + 2m_J\left(p - f\right)i^3 - \left(3m_j + pf\right)i^2 - l = 0 \tag{4}$$

Assuming operation in idle operation $M_S = 0,\ p \to \infty,\ \mathrm{f} \to \infty$, the previous condition reduces to the form:

$i^2 m_j - 1 = 0$, optimal value, frequently encountered in literature (Fig. 1):

$$i_{op} = \sqrt{\frac{1}{m_j}} = \sqrt{\frac{J_L}{J_M}} \tag{5}$$

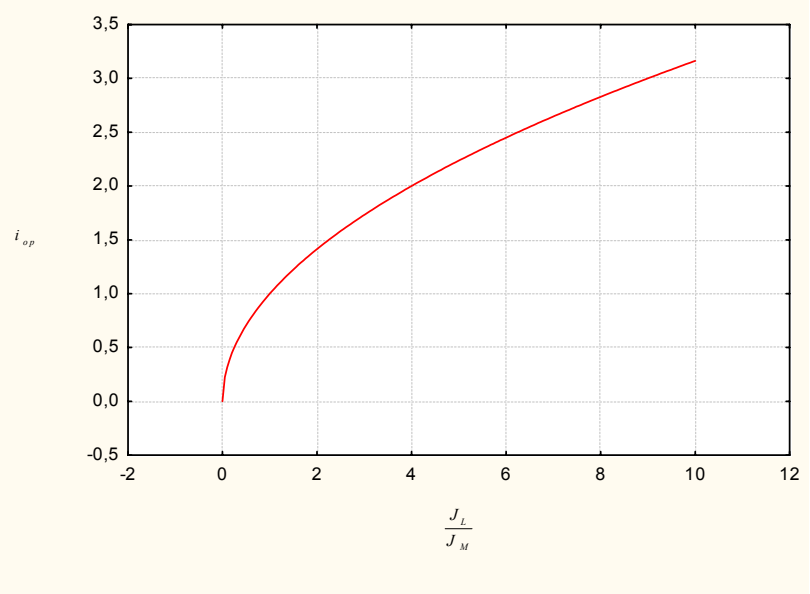

Fig. 1

Maximum acceleration resulting from the replacement ratio transmission with its optimal value:

$$\dot{\omega}_{L\max} = \frac{M_p}{J_M} \frac{i_{op} - \frac{M_S}{M_p}}{i_{op}^2 + \frac{J_L}{J_M}} \tag{6}$$

Maximum acceleration during startup is:

$$\varepsilon_{\max} = \dot{\omega}_{L\max} = \frac{M_p}{2J_M} \frac{\sqrt{\left(\frac{M_p}{M_s}\right)^2 + \frac{J_L}{J_M}}}{\left(\frac{M_p}{M_s}\right)^2 + \frac{J_L}{J_M} + \sqrt{\left(\frac{M_p}{M_s}\right)^2 + \frac{J_L}{J_M}}} \tag{7}$$

Comparison of acceleration to its maximum value, we get

$$\varepsilon_r = \frac{\dot{\omega}_L}{\dot{\omega}_{L\max}} = 2i_{op} \frac{J_M}{M_p} \frac{iM_p - M_S}{i^2 J_M + J_L} = 2\left(\frac{M_s}{M_p} + \sqrt{\left(\frac{M_s}{M_p}\right)^2 + \frac{J_L}{J_M}}\right) \cdot \frac{i - \frac{M_s}{M_p}}{i^2 + \frac{J_L}{J_M}} \tag{8}$$

obtain a function with a more convenient graphical representation (fig.2), with the possibility of obtaining some general conclusions.

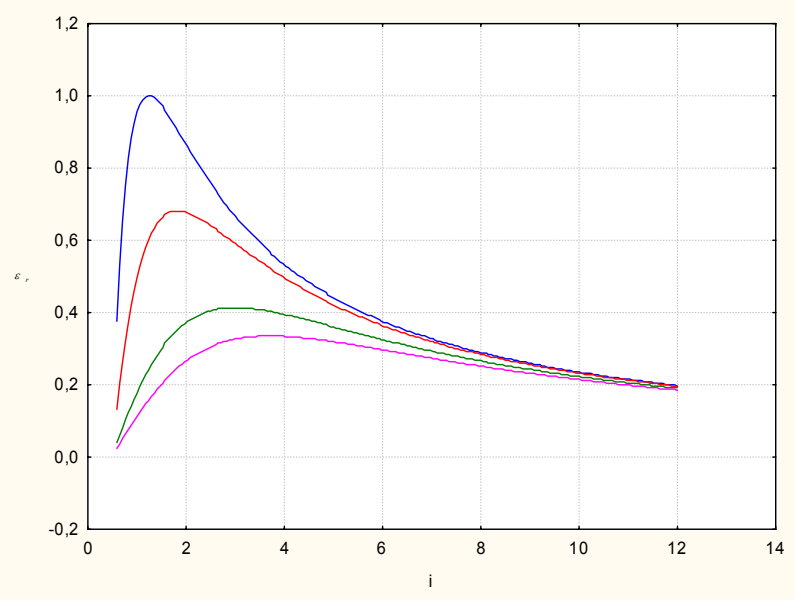

Fig. 2

3. CONCLUSIONS

From the above analysis highlights the following conclusions:
- Optimal i_{op}, of the transmission ratio increases with increasing reports J_L / J_M and M_s / M_p. So the power of working with couples large static moments of inertia have to use gear while working with couples mechanisms static or low moments of inertia may be used to direct coupling;
- Acceleration first increases rapidly to a maximum and then decreases slowly with increasing transmission ratio, hence the choice of transmission ratio is the optimal value or slightly higher;
- Maximum accelerations values are all higher as reports M_s / M_p and J_L / J_M are lower

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