ON-LINE RECONFIGURATION OF A CONTROL SYSTEM BASED ON INFORMATION FUSION

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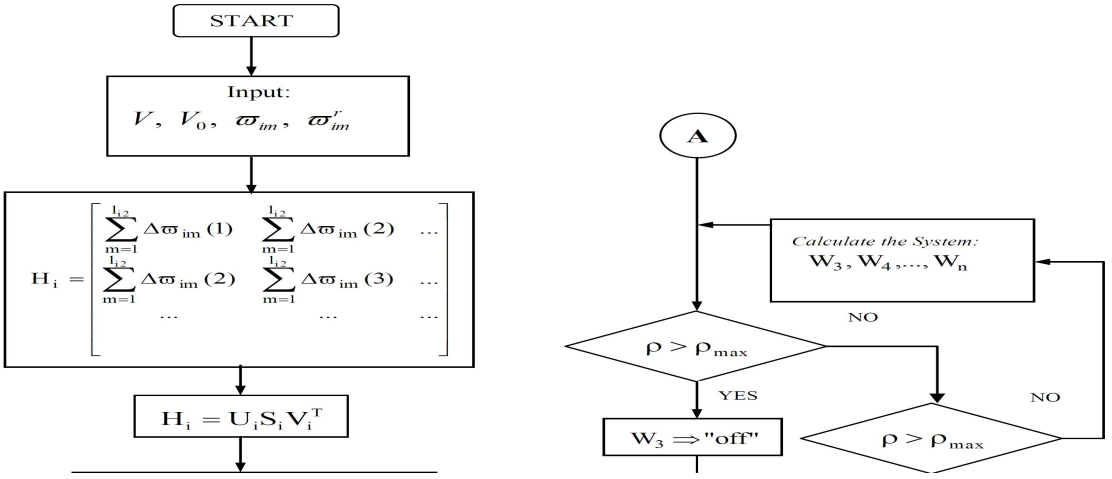
It is proposed that the on-line reconfiguration of the control system is based on the information from the current load of the conveyer. Consider the case when a load on the conveyer is reduced on-line to z-% from its nominal value. It is not a necessity to use all n units (subsystems W_i) for maintaining the desirable conveyer speed V_0. Therefore the number of on-line operating subsystems can be reduced and the speed can be maintained in the desirable limits ($V_0 \pm \Delta V$), where ΔV - is a deviation of the conveyer speed from V_0. As a result the state vector in each subsystem and the number of channels which deliver these states can also be reduced. In effect, all data can be processed much faster and this releases the computational resources for other purposes such as data acquisition with high sampling rate. To implement the control algorithm, it is proposed that a special form of the information matrix $H_i(\Delta\varpi_{im}(k))$ is constructed, where $\Delta\varpi_{im} = \varpi_{im} - \varpi_{im}^{r}$, $\Delta\varpi_{im}$ - is the error between the measurement speed of the rotor shaft of the m- motor in the i-th cluster and its reference speed, k - is the number of samples from a tachometer. Using the singular value decomposition (SVD) procedure on the Hankel matrix $H_i(\Delta\varpi_{im}(k))$, the matrix $S_i = \mathrm{diag}(\sigma_{i1}, \sigma_{i2}, ..., \sigma_{iq})$ can be obtained, where σ_{iq} - are singular values [1], [2]. The Frobenious norm of the matrix S_i can be used as a measure of speed accuracy of the m-th motor. Rearranging the results as $\|S_1\|_F > \|S_2\|_F > ... > \|S_n\|_F$ the effectiveness of each motor can be determined (according to the criterion $\Delta\omega_{im} \to 0$) and the relevant local processor operating in the subsystem i can be switched off according to the index performance $\rho > \rho_{max}$, where $\rho = \dfrac{V_0 - \Delta V}{V_0}$, ρ_{max} - is the maximum limit of the desirable accuracy. In the next cycle the procedure is repeated with the retained (n-1) subsystems. With reference to the desirable accuracy, the subsystem with the next minimal norm can also be disconnected and so on. Thus, the number of local processors operating on the task of maintaining ($V_0 \pm \Delta V$) can be considerably reduced in some operational regimes. Relevant electric motors are switched on when the performance index $\rho < \rho_{min}$, where ρ_{min} - is the minimum limit of the desirable accuracy. The procedure of determining the effectiveness of the local subsystems is repeated with the period T, which can be determined experimentally. The on-line reconfiguration algorithm is presented in the flow-chat (Figure 1). The overall system can be on-line reconfigured according to the information on the current load and effectiveness of local control units. This allows faster data processing, which facilitates a higher accuracy speed control.

Keywords: System reconfiguration, control systems, information fusion, Singular Value Decomposition.

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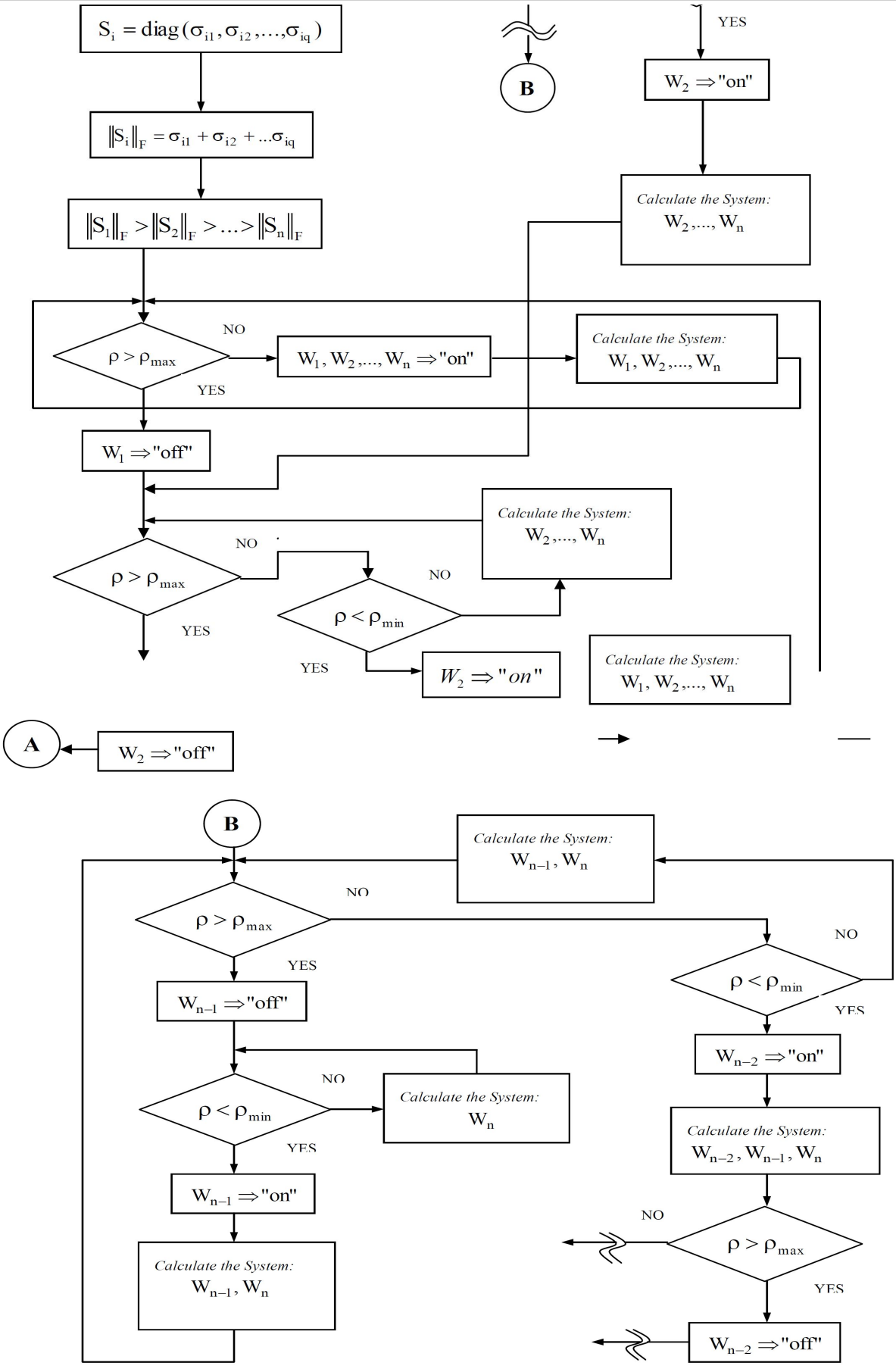

$S_i = \mathrm{diag}(\sigma_{i1}, \sigma_{i2}, \ldots, \sigma_{iq})$
$\|S_i\|_F = \sigma_{i1} + \sigma_{i2} + \ldots \sigma_{iq}$
$\|S_1\|_F > \|S_2\|_F > \ldots > \|S_n\|_F$
$\rho > \rho_{max}$
NO
YES
$W_1, W_2, \ldots, W_n \Rightarrow$ "on"
Calculate the System: $W_1, W_2, \ldots, W_n$
$W_1 \Rightarrow$ "off"
Calculate the System: $W_2, \ldots, W_n$
$\rho < \rho_{min}$
$W_2 \Rightarrow$ "on"
Calculate the System: $W_1, W_2, \ldots, W_n$
$W_2 \Rightarrow$ "off"
A
B
$W_2 \Rightarrow$ "on"
Calculate the System: $W_2, \ldots, W_n$
Calculate the System: W_{n-1}, W_n
$W_{n-1} \Rightarrow$ "off"
$W_{n-2} \Rightarrow$ "on"
Calculate the System: W_n
Calculate the System: W_{n-2}, W_{n-1}, W_n
$W_{n-1} \Rightarrow$ "on"
$W_{n-2} \Rightarrow$ "off"

Fig.1