THE MAIN PRINCIPLES OF FOOD RODUCTION PROCESSES AND EQUIPMENT MATHEMATICAL MODELS CREATION

Evgeny Shtefan[1*]

[1]*National University of Food Technologies, 68, Volodymyrska str., Kyiv, Ukraine*
[*]*info@nuft.edu.ua*

The mathematical imitation modelling of the food manufactures technologies can serve as the basis of the information practice of design (IPD) of food production equipment.
The main principles of the corresponding models creation are defined by the IPD type: “mathematical model - intellectual expert system - design automation system”. The mathematical modelling method is based on thesis: the technological processes is the multicomponential system of interconnected subjects of inquiry: edible raw materials, technological equipment elements, thermo- mechanical loading means etc. IPD is based on carrying out of the numerical experiments which realize the analytical, algorithm and digital models.
At construction of the *analytical model* of mechanical behaviour of the food medium we are guided by a principle of its conditional division on three groups: 1 - solid particles; 2 - water in various kinds and conditions; 3 - gaseous inclusions. The mathematical model construction of disperse systems behavior in food productions no equilibrium processes is offered. The constitutive relations describe the conditions of elastic - viscous - plastic flow of a solid phase.
he *algorithm model* is based on use of the net-point methods of the decision of the formulated boundary problems. There have been elaborated methods for put problem decision with use of finite element method on spatial parameters and finite difference method on time argument. The calculation algorithms are designed for most typical food technologies processes (compaction, extrusion, filtration, forming and mass transfer of elastic - viscous - plastic food masses).
The program system PLAST-002 ensuring the high level automatic condition of numerical experiments is working out upon these algorithms (*digital model*).
Within the framework of IPD the developed digital models using has allowed to perform a complex design calculation by consideration typical technological operations of disperses materials processing in food productions.

KEY WORDS: mathematic modelling, disperse materials, designing, intellectual expert system

FATIGUE DAMAGE OF TURBINE SHAFTS OF SUGAR PLANTS AT ASYNCHRONOUS CONNECTIONS OF TURBOGENERATOR TO THE POWER NETWORK

Valeriy Kuevda[1], Anatoliy Bovsunovsky[1*], Iuliia Kuievda[1], Evgeniy Shtefan[1]

[1]*National University of Food Technologies, 68, Volodymyrska str., Kyiv, Ukraine,*
[*]*apbovsunovsky@gmail.com*

The increase of durability of power equipment of sugar plants is the actual problem. One of the important component part of this problem is the torsional vibration of turbine shafts caused by the action of the reactive electromagnet moments which arise at asynchronous connections of turbogenerator to the power network. In some cases the torsional vibration of turbine shafts leads to theirs essential fatigue damage.
In service conditions of turbogenerators on sugar plants the asynchronous automatic connection of turbogenerator to the power network or its resynchronization are frequently used. In this case the reactive electromagnet moment M_{max} which effect the turbine shaft can exceed in several times the nominal torsional moment M_n of the turbine. For example, our calculations such a reactive electromagnet moment in the case of definite initial angle of phase shift θ between the vector of electromotive force of T-12-2 turbogenerator and the vector of supply-line voltage with account for the step-up transformer on the supply-line by length of 50 km which connect the turbogenerator with the power network of 110 KV gave the following results: in the case θ=30° M_{max}=1.85 M_n; in the case θ=60° M_{max}=3.15 M_n; in the case θ=120° we have the maximal possible value M_{max}=4.8 M_n . At more close location of power network as regard to the sugar plant the values M_{max} may increase in several times because of the decrease of electric resistance of the supply-line.
The calculations of fatigue damage of most strained parts of the turbine shaft at forced torsional vibration were executed with the ANSYS software (modal analysis). The results of calculations have revealed that at definite distance of sugar plant from the power network of 110 KV (that is 50 km) and in the range of phase shift angles θ=0…70° the fatigue damage of most strained areas of turbine shaft as a result of cyclic torsion over the assigned service time of the turbine (2000 startups) takes place but does not attain the marginal state of the material. However in condition that θ≥30° the level of fatigue damage of the shaft material should be taken into account in calculations of residual durability of turbine shafts.

KEY WORDS: turbine, fatigue damage, asynchronous connections