

SPECIAL ISSUE

Dedicated to the 1st conference "Simulation-modelling, and computer aides design in the field of agricultural machines and food industry"- AMFI 2007

C o n t e n t s

BIOTECHNICAL SYSTEMS

Tudor Casandroi, Gheorghe Voicu, Li-Hua Ioana Chih Researches regarding the use of cone penetration for rheological behaviour characterization of some wheat flour doughs	3
Sorin-Stefan Biris, Edmond Maican, Gigel Paraschiv, Valentin Vladut, Sorin Bungescu A model for prediction of stress state in soil below agricultural tyres using the finite element method	19
Gheorghe Voicu, Tudor Casandroi, Gabriel Stan Using the dimensional analysis for a mathematical model to predict the seeds losses at the cleaning system of the cereals harvesting combines	29
Adrian-Gabriel Ghiaus, Robert Gavriiuc Simulation of air flow and dehydration process in tray drying systems	41
Edmond Maican, Sorin-Stefan Biris Optimum width calculus of the reel blades from the cereal harvesting combines	51
Vasile Craciun, Ovidiu Balan, Ion Baisan Trajectoire de la particule du sol sur le versoir pendant le processus de labourage	59
Victor – Viorel Safta, Magdalena – Laura Toma The layout of the successive impurities cleaning devices from the bulb and tubercle harvesters	67
Nedka Stancheva, M.Marinov, D. Stanchev Methods for selection of the engines of agricultural tractors according to fuel economy	77

George Ipate, Tudor Casandroi

Numerical study of liquid-solid separation process inside the hydrocyclones with double cone sections

83

Mirela Panainte, Valentin Nedeff, Carmen Savin, Emilian Mosnegutu, Bogdan Macarescu

Determination of energy consumption at grinding through heating at different species and sorts of fruits with variable texture

95

Antoaneta Dobreva, V. Dobrev

Research of technical parameters of transmissions for vehicles and agricultural machines

103

RESEARCHES REGARDING THE USE OF CONE PENETRATION FOR RHEOLOGICAL BEHAVIOUR CHARACTERIZATION OF SOME WHEAT FLOUR DOUGHS

Tudor CASANDROIU, Gheorghe VOICU, Li-Hua Ioana CHIH

In this paper is presented the researches results regarding the possibility to characterize the wheat flour dough consistence (an important property of its rheological behaviour as a material with viscoelastic properties), by variation of depth penetration vs. time, of a cone driven by his gravitationally weight.

During experimentations it was used a standard solid plexiglas cone with a 90° apical angle, driven by his gravitationally weight corresponding to mass of 14.1 g. It is used dough samples prepared by hydration (with and without salt, 1.5 g) different wheat flours from Romania zone, with 55 ml distilled water for flour amount 100 g. It was tested the Velon law currency type $h = a \cdot \ln t + b$, (h – penetration depth, t – time, a , b – coefficients), for which was found a correlation coefficient $R^2 > 0,97$ and the possibility to appreciate the dough consistency (in direct relation with the gluten quality, by his component glutenine, which preponderant confer the elasticity property of viscoelastic dough) through the maxim depth of penetration, h_{max} .

The obtained data are used both to elaborate a testing procedure for flour bread making quality and for selection and dosing the raw materials.

Key words : wheat flour dough, bread, quality, consistence, rheological properties, cone penetration

A MODEL FOR PREDICTION OF STRESS STATE IN SOIL BELOW AGRICULTURAL TYRES USING THE FINITE ELEMENT METHOD

Sorin-Stefan BIRIS, Edmond MAICAN, Gigel PARASCHIV,
Valentin VLADUT, Sorin BUNGESCU

This paper presents a model for prediction the stress state in agricultural soil below agricultural tyres in the driving direction and perpendicular to the driving direction which are different from one another, using the finite element method.

In present, one of the most advanced methodologies for modelling the phenomenon of stresses propagation in agricultural soil is the finite element method, which is a numerical method for obtaining approximate solutions of ordinary and partial differential equations of this distribution. In this paper, the soil has been idealised as an elastoplastic material by Drucker-Prager yield criterion.

Keywords: Finite element method, agricultural soil, tyre, stress state

USING THE DIMENSIONAL ANALYSIS FOR A MATHEMATICAL MODEL TO PREDICT THE SEEDS LOSSES AT THE CLEANING SYSTEM OF THE CEREALS HARVESTING COMBINES

Gheorghe VOICU, Tudor CASANDROIU, Gabriel STAN

*For the first time in this paper the theory of dimensional analysis for a mathematical model of the process of seeds separation is analyzed at the cleaning system level of the cereal harvester combines, in order to predict the seeds losses of the system. Relying on theoretical studies and previous experiments, seven most important parameters that are characteristic for the separation process, were taken into consideration. Applying Buckingham **P** theorem from the dimensional analysis theoretical basis, as a result the following criteria of dimensional similitude for the mathematical model used for*

the losses reduction in the cleaning system, a clear relation was determined between the similar criteria as an equation of the following type: $p/(q \cdot D_j) = k \cdot (D_j \cdot f / v_a)^a (L_s / D_j)^b I^c$, where: q (kg/m/s) is the specific feed rate flow; v_a (m/s) – the air velocity; I – the masses ratio between material other than grains (m.o.g.) and seeds; D_j (m) – the orifices opening of Petersen cleaning system; f (s⁻¹) – the oscillation frequency of the sieves; L_s (m) – the length of the sieves; p (kg/s) the seeds losses and k , a , b , c – coefficients determined according the experiments data.

The suggested relation was tested having the data of the experimental research on a laboratory stand equipped with a traditional cleaning system with already known constructive and functional characteristics. The following coefficients values were obtained $k = 0,137 \cdot 10^{20}$; $a = 4,901$; $b = -5,640$; $c = -5,257$, for a correlation coefficient $R^2 @ 0,837$.

This paper proves that the suggested mathematical model can be use in order to predict with accuracy the losses of seeds in a cleaning system of the cereals harvest combine. This model may be used by the harvest combine designers as well as by any user.

Key words: cereal harvesting combines, cleaning system, seeds losses, dimensional analysis, and mathematical model

SIMULATION OF AIR FLOW AND DEHYDRATION PROCESS IN TRAY DRYING SYSTEMS

Adrian-GabrielGHIAUS, Robert GAVRILIUC

Drying systems, as great energy consumers, need an actual optimization based on dynamic mathematical models, analysis and numerical simulations. The system behaviour is direct influenced by the air velocity above the product bed (which change due to the product shrinkage), by the thermo-physical properties of the produc depending on temperature and moisture content - variable in time, as well as by the transfer coefficients and drying air properties. The air flow inside the drying room is investigated by means of well established C.F.D. code.

Flow simulation for different geometrical configurations, showing stream lines, velocity vectors and pressure distribution diagrams, dictate the right arrangement to be used.

Keywords: batch drying units; drying process; tray dryer; numerical simulation

OPTIMUM WIDTH CALCULUS OF THE REEL BLADES FROM THE CEREAL HARVESTING COMBINES

Edmond MAICAN, Sorin-Stefan BIRIS

This paper deals with a new methodology for the calculus of the optimum reel blades' widths (or elastic fingers' lengths) from the cereal harvesting combines. It is taken into consideration the position of the plants' centers of gravity and also the seeds mass distribution on a vertical axis, in regard to the soil level. The mathematical model was adopted for a real case, with plants of different heights which are not perfectly straight and vertical. The calculus is based on values from experimental measurements made on five different species of wheat from Romania.

Key words: cereal harvesting combine, reel, optimization, mathematical model

TRAJECTOIRE DE LA PARTICULE DU SOL SUR LE VERSOIR PENDANT LE PROCESSUS DE LABOURAGE

Vasile CRACIUN, Ovidiu BALAN, Ion BAISAN

In the paper the authors present a new mathematical description for the mouldboard plough surface. On the base of the equations for the working surface physical and mechanical properties of the soils and the forces exerted on the soil block traveling over the plough mouldboard, the author established the differential equations

for the motion of the soil element. Through integration of these equations using numerical methods one obtain the path of the soil element over the mouldboard. This method make possible the prediction of soil forces reactions and formulate and solve the problems for optimization the mouldboard plough surface.

Dans ce ouvrage une nouvelle méthode pour la détermination par calcul des trajectoires des particules de sol sur le versoir est proposée. Une fois connue la trajectoire théorique, elle permet la comparaison avec la trajectoire obtenue suivant les données expérimentales d'où on peut faire une évaluation au niveau théorique des forces de résistance dans le processus de labourage. Par l'utilisation de certains programmes de calcul appropriés, l'optimisation de la surface de travail (le versoir) et des régimes d'exploitation deviennent possible.

Key words : mouldboard surface equations, equations of the soil slice movement

THE LAYOUT OF THE SUCCESSIVE IMPURITIES CLEANING DEVICES FROM THE BULB AND TUBERCLE HARVESTERS

Victor – Viorel SAFTA, Magdalena – Laura TOMA

In the paper is presented a methodology for the layout of the successive cleaning devices, namely with rolling conveyors, from the impurities cleaning system of the bulb and tubercle harvesters. The methodology contains the mathematic model of the material passage on successive cleaning devices, the calculus algorithm of the relative position between the cleaning devices and the software based on it.

Keywords: bulb and tubercle harvesters, impurities cleaning systems, the layout of the successive rolling conveyors, mathematic modelling, calculus algorithm, software.

METHODS FOR SELECTION OF THE ENGINES OF AGRICULTURAL TRACTORS ACCORDING TO FUEL ECONOMY

Nedka STANCHEVA, M.MARINOV, D. STANCHEV

Methods for selection of the engines of agricultural tractors, in order to insurance of the minimum fuel consumption, is suggested. The essence of methods reduces to selection of the engine power as be based on the requirement for the most likely working regimes the engine to work at regime near to minimum specific fuel consumption. Concrete data, for determination and selection of the fundamental tractor parameters, are given in this paper, with which to be able the methods apply at design and research of exploitation properties of the tractors.

Keywords: agricultural tractors, minimum fuel consumption.

NUMERICAL STUDY OF LIQUID-SOLID SEPARATION PROCESS INSIDE THE HYDROCYCLONES WHIT DOUBLE CONE SECTIONS

George IPATE, Tudor CASANDROIU

The major objective of this study was, using the modern numerical techniques, to investigate particle transport processes within a hydrocyclone whit double cone sections, were the wastewater is deperated. This investigation consists of calculations of the fluid flow inside the hydrocyclone, including particle trajectory, pressure losses and separation efficiencies. The hydrocyclone has modeling whit the proper geometrical relationship between the cyclone diameter, inlet area, vortex finder, apex orifice, and sufficient length providing retention time to properly separation particles. Obtained results of calculations were numerically verified as well as compared with results published in the subject literature. The model will predict the velocity particle and fractional recovery of solid particles

requirements given the dimensions of the cyclone, the physical properties of the fluid, and the volumetric flow rate.

Keywords: hydrocyclones; model; mixture; performance; geometrical proportions; efficiency

DETERMINATION OF ENERGY CONSUMPTION AT GRINDING THROUGH HEATING AT DIFFERENT SPECIES AND SORTS OF FRUITS WITH VARIABLE TEXTURE

Mirela PANAINTE, Valentin NEDEFF, Carmen SAVIN

Vegetable products are visco - elastics and their elasticity vary considerably and depend on maturity degree and the humidity of the product. From all vegetable products, horticultural products, respectively fruits have the most variable properties in time and space. The paper presents a method for determination the energy at grinding of products with variable texture (fruit), in case of the grinding the products through shearing. The determination was performed in laboratory conditions with the help of breaking test, on processing test specimens.

Keywords: grinding energy, energy consumption, broken, vegetable

RESEARCH OF TECHNICAL PARAMETERS OF TRANSMISSIONS FOR VEHICLES AND AGRICULTURAL MACHINES

Antoaneta DOBREVA, V. DOBREV

The technical parameters of transmissions for vehicles and agricultural machines are investigated. A summarized analysis and an evaluation considering different criteria are carried out. Options for the improvement of the technical parameters of transmissions for

vehicles and agricultural machines through a multidimensional optimization and design are suggested as a result of the research.

Keywords: technical parameters, vehicles and agricultural machines,
multidimensional optimization and design