Computer Simulation in Palm Kernel Cracking Machine Design

RUFUS OGBUKA CHIME[1], OGBEIDE S.O (PH.D) [2]
[1]*Mechanical Engineering Department, IMT, Enugu, Nigeria*
[2]*Ambrose Alli University, Faculty of Engineering and Engineering Technology, Department of Mechanical Engineering, Ekpoma, Edo State, Nigeria*

Abstract- ***Computer simulation is the reproduction of the behavior of a system using a computer to simulate the outcomes of a mathematical model associated with said system. Since they allow to check the reliability of chosen mathematical models, computer simulations have become a useful tool for the mathematical modeling of many natural systems in physics (computational physics), astrophysics, climatology, chemistry, biology and manufacturing, human systems in economics, psychology, social science, health care and engineering . Simulation of a system is represented as the running of the system's model. It can be used to explore and gain new insights into new technology and to estimate the performance of systems too complex for analytical solutions An improve cracker is needed for the cracking of palm kernel in large scale to satisfy this yearning. The process of palm kernel oil needs a nut shell cracking which is the most critical and delicate aspect which is labour intensive if done manually. The individuals involved in the manual cracking endanger their selves of inadvertently hitting their fingers with the impact stone. The palm kernel cracking machine is power driven and it is constructed so as to increase efficiency of cracking the nuts, reduce accidents during operation and minimize the expelling of time during the process). Due to the continuous increase in demand for palm kernel nuts for soap, cream, and cooking oil, there is need to produce it with local source materials ,As a result of researching innovation have be made to solve the problem of traditional method by using mechanized type. our aim is to ensure that the product can be manufactured at a feasible cost, presented followed by the computer-based area of virtual manufacturing for simulating manufacturing operations, Simulation analysis of the models and design was carried out using Autodesk inventor professional application.***

Indexed Terms- ***Design, Computer Simulation, Palm Kernel Cracker Manufacturing, and Sustainability***

I. INTRODUCTION

Computer simulations, or models, are computer programs that can predict or create a theoretical reality based on algorithms and statistical probabilities. The algorithms are designed to predict the most likely outcome/interactions and can be a useful tool in many engineering industries to determine the optimal working procedures. Computer simulations in their most basic sense are a step-by-step mathematical approximation applied to a real-world or theoretical environment.

A simulation process generally proceeds through a logical series of operations. Once a model is chosen, a method to implement the model can be performed on a computer which calculates the algorithm output and allows for visualisation of the data. This complete series of steps provides the best theoretical result possible for a real-world example. Real-world examples can be unpredictable, depending on the environment, so the theoretical is not always colloquial with the actual.

The most common types of simulation are equation-based, agent-based, Monte Carlo and multiscale simulations. Even within these areas there are many sub-sets depending on the attributes that the simulations enforce. These can be stochastic or deterministic, discrete or continuous, local or distributed dynamic systems. The difference between these types of simulation produces drastically different operating functions. Stochastic simulations use random number generation to model events, whereas deterministic simulations follow determined

parameters and conditions. Continuous simulations produce numerical models based around differential and algebraic equations, but discrete simulations are known for their rotational degrees-of-freedom and complex geometries. Distributed models run on a series of connected computers, whereas local distributions are limited to one machine.

- **Simulation** of a system is the operation of a model in terms of time or space, which helps analyze the performance of an existing or a proposed system. In other words, simulation is the process of using a model to study the performance of a system. It is an act of using a model for simulation
- **Modelling** is the process of representing a model which includes its construction and working. This model is similar to a real system, which helps the analyst predict the effect of changes to the system. In other words, modelling is creating a model which represents a system including their properties. It is an act of building a model.

The fast growing Agro & allied processing and manufacturing industries would survive if the constant supply of raw materials for their production. An improve cracker is needed for the cracking of palm kernel in large scale to satisfy this yearning. The process of palm kernel oil needs a nut shell cracking which is the most critical and delicate aspect which is labour intensive if done manually. The individuals involved in the manual cracking endanger their selves of inadvertently hitting their fingers with the impact stone. The palm kernel cracking machine is power driven and it is constructed so as to increase efficiency of cracking the nuts, reduce accidents during operation and minimize the expelling of time during the process).operations,

For more than five to six decades, several methods have been adopted in order to crack palm kernel. The methods include cracking with stone and smashing against a rock. These methods are time-consuming, extend human energy, the danger of smashing the fingers and low production. Due to the continuous increase in demand for palm kernel nuts for soap, cream, and cooking oil, a result of increasing human population, researchers are forced to come up with better, faster and safer ways of separating the palm kernel nut from its shell. The increasing production of oil from the palm fruit gives rise to palm kernel nut. The bye product and utilization of palm kernel shell for biofuel and other, led to the demand for quick and easy separation of palm kernel nut from it shell. The basic features of the machine include a horizontal shaft, hopper, cracking chamber, pulleys, and bearings with housing, discharge outlet and electric motor (prime mover) the designed machine was operated by a 4hp electric motor.

- **Problem Statement/Justification**

The individuals involved in the manual cracking endanger their selves of inadvertently hitting their fingers with the impact stone. The palm kernel cracking machine is power driven and it is constructed so as to increase efficiency of cracking the nuts, reduce accidents during operation and minimize time

II. LITERATURE REVIEW

The invention of the CAD is probably the most revolutionizing optimization tool developed by humans. In today's complex business and industrial environments, the solution of operational problems cannot be achieved by technological advances alone. The multitude of options available for implementing an operational plan has mandated the development of systematic procedures for selecting the options that best benefit the organization as a whole. The optimization models of operations research are designed to solve such complex problems.

Since the dawn of computer simulation in the late 1940s with the infancy of the Monte Carlo method (Metropolis and Ulam 1949), it has been recognized that appropriate statistical methods must be to the output of stochastic simulations in order to evaluate the performance of the system or process under study. The unfortunate lack of attention to this in too many applications may have been a main factor to simulation's having acquired, early-on, the unwarranted but surprisingly sticky epithet "the method of last resort" (Harling 1958; Wagner 1969; Lucas et al. 2015).

Almost as early, some researchers (Conway et al. 1959; Conway 1963; Fishman 1967) started investigating more closely the statistical nature of

simulation-generated output, and began offering constructive ideas on how to deal with the fact that these data tend to break the rules of classical statistics (such rules include being independent, identically distributed, normally distributed, and stochastically stationary). For example, successive times in queue (or in system) of parts exiting a manufacturing system are generally serially dependent (since a large, say, observation might tend to be followed next by another large observation), have distributions that cannot be negative (so cannot be normal), and tend to have initial trends, e.g., after a possibly-unrealistic starting condition like empty and idle. At the same time, simulation-generated output data offer advantages over traditional physically-collected data sets, especially in terms of sample size. Since then, this field has grown and matured, and has had increasing impact on the good practice of simulation via implementation of methods and recommendations in simulation software, promoting their everyday use in projects.

In 1986 the Winter Simulation Conference program, under the leadership of Program Chair Stephen D. Roberts, split the "Methodology" track into two separate full tracks, Modeling Methodology and Analysis Methodology, the latter of which has since then focused on the statistical issues of interpreting simulation output data. time, simulation-generated output data offer advantages over traditional physically-collected data sets, especially in terms of sample size. Since then, this field has grown and matured, and has had increasing impact on the good practice of simulation via implementation of methods and recommendations in simulation software, promoting their everyday use in projects.

The cracked shell can be used for road constructions, brake pads and coarse aggregate in concrete for building (Mahmud et al., 2009). The chaff and shell are used locally for the manufacture of candles and as fuel for cooking. Thus, every part of the palm fruit or its by-products is economically useful (Patrick and Godspower, 2014).

In the processing of kernel oil, nut shell cracking is the most critical and delicate operation. Its major concern is to extract the fragile kernel whole from the shell. Cracking palm nuts to release the kernels is a critical step that affects the quality of kernel oil. There are two types of modern palm kernel crackers; the hammer impact and the centrifugal impact types. These modern crackers are not free of limitations. Hammer impact type breaks or cracks the nut on impact when the hammer falls on it; while centrifugal impact nut cracker uses centrifugal action to crack the nut (Ndukwu and Asoegwu, 2010). The effective separation of the cracked palm nut mixture is an important process in the utilization of the constituent palm kernel and the shell in some existing and emerging agro-economy. The kernels are not useful until they are separated from the shell

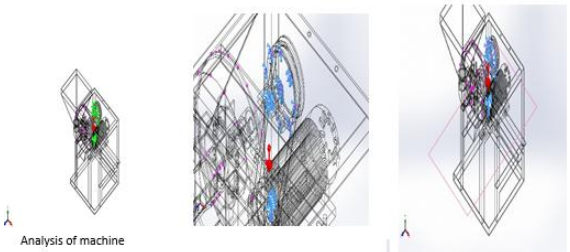
The usual way of cracking palm nut to get the kernel is a time consuming and labor intensive process (Oke, 2007). Researchers have employed several methods and media like water, clay, carpets fans, blowers and sieves to separate palm kernels from the shell but nobody has reported success rate above 60% for the separation of palm nut and shell.

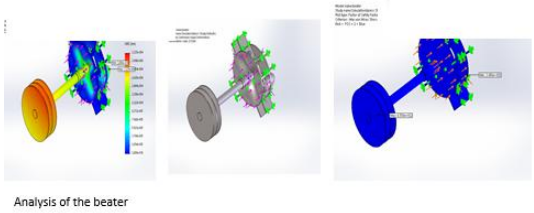
The usage of methods including clay and water further complicates the separation process as heat would be needed in order to dry the shell before they can be stored (Oguoma et al., 1993; Obiakor and Babatunde, 1999; Koya and Faborode, 2006). Conventionally, palm kernel cracking machines usually work on the principle of impact either using centrifugal means to deliver the energy or using the hammer mill. In brittle materials, rupture may occur in the early portion of the force-deformation curve beyond the linear limit, while it may take place after considerable plastic flow in tough material (Mohsenin, 1986). Palm nut in a natural rest position lies longitudinally so that the impact is applied along the lateral axis. Conventional mechanical nut crackers are often of the centrifugal type (Manuwa, 1997; Obiakor and Babatunde, 1999; Ojolo et al., 2015). The nuts are either fed into a slot on a rotor turning at a very high speed or are fed into a cracking chamber where they are impacted upon by metal beaters turning at a high speed which throws the nuts against a cracking ring. The speed is adjusted for acceptable cracking efficiency. The nuts impinge the wall at random orientations but with repeated impact due to bouncing until they are discharged, cracked or uncracked albeit with much kernel breakage (Obiakor and Babatunde, 1999). The knowledge of minimum impact force required for nut cracking is therefore

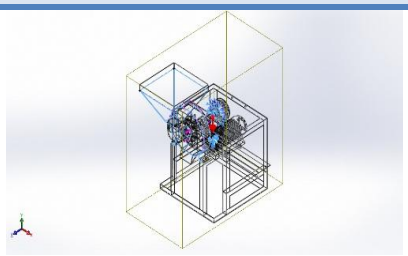
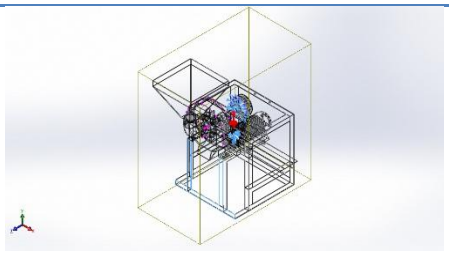
paramount to design improvement of the existing mechanical nut crackers (Koya and Faborode, 2005). Efficient cracking and separation of cracked palm nut shell from kernel has been an age long problem in the processing of vegetable oil in Nigeria. Largely, this has hindered the production of palm kernel in large quantities to satisfy the yearnings of agro-allied processing and manufacturing industries (Agulanna et al., 2013). Cracking and separating processes are two major operations that require serious development for drastic improvements in quality and quantity of palm kernel oil produced in Nigeria.

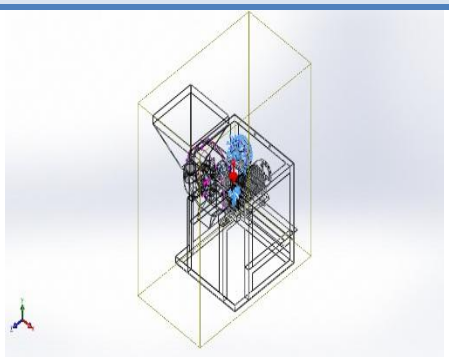
Adewale and Koya (2014) evaluated a rotary drum separator for the dry mixture of palm kernel and shell. Ojolo et al., (2015) developed a variable size nut cracker. However, existing devices have limitations in solving the problem completely (Koya and Faborode, 2006). Therefore, the main objective of this study was to design a low cost, easy to use cracking machine separation of palm kernel from the shell. There is a need to investigate some properties that affect cracking and separation of palm nuts in order to boost vegetable oil production, reduce wastage during processing, promote small scale production of processing machines and aid small scale processors to meet the demand of palm kernel processing in a developing economy like Nigeria.

- Simulation Analysis of Machine and the Components





Sensor name	Location	Sensor Details
Material Cost1		Value : Entities :5 face(s), 1 component(s) Result :Workflow Sensitive Component :NA Criterion :Max over Selected Entities Step Criterion : - Step No.:1 Alert Value: NA
Sensors1		Value : Entities :1 edge(s), 1 face(s), 1 component(s) Result: Displacement Component :URES: Resultant Displacement Criterion :Model Max Step Criterion : Across all Steps Step No.:1 Alert Value: is less than 1

Sensor name	Location	Sensor Details
Stress1		Value : Entities :2 edge(s), 1 face(s), 1 component(s) Result :Stress Component :VON: von Mises Stress Criterion :Max over Selected Entities Step Criterion : Across all Steps Step No.:1 Alert Value: is greater than 0 (N/m^2)^2/Hz

Banks et al.(2009).

1) Design
2) Modelling
3) Simulation
4) Sustainability analysis

- Modeling and Simulation
  - A model can be used to investigate a wide verity of "what if" questions about real-world system.
  - Potential changes to the system can be simulated and predicate their impact on the system.
  - Find adequate parameters before implementation
  - So simulation can be used as
  - Analysis tool for predicating the effect of changes
  - Design tool to predicate the performance of new system
  - It is better to do simulation before Implementation.

Sustainability In Designis becoming a growing area where designers as well as engineers areneeded by many companies with an experience of combining the impact on environment in consideringdevelopment in their various project. Although, it may not be a strong pillar as a profession for a designer,it will nevertheless, become increasingly a component which is standard for the process of design, so to get ahead of the curve is the best thing to do.

- Computer Simulation In Palm Kernel Cracking Machine Design

Computer simulation is often used as an adjunct to, or substitute for, modeling systems for which simple closed form analytic solutions are not possible. There are many types of computer simulations; their common feature is the attempt to generate a sample of representative scenarios for a model in which a complete enumeration of all possible states of the model would be prohibitive or impossible

In order to produce good models that can be used to produce realistic results, these are the necessary steps that need to be taken in order to ensure that simulation models are functioning properly. Simulation models can be used as a tool to verify engineering theories, but they are only valid if calibrated properly. Once satisfactory estimates of the parameters for all models have been obtained, the models must be checked to assure that they adequately perform the intended functions

With respect to the importance and merits posed by palm kernels, the demand for it in the world markets is increasing daily. Palm kernel from the cracked palm nuts are crushed in the palm kernel mill to get the palm kernel oil that is useful in making soap, glycerine, margarine, candle, pomade, oil paint, polish and medicine. The palm kernel oil is also used in the production of fuel and biodiesel. The kernel cake on the other hand serve as ingredient for livestock feeds and it is widely used in livestock industries while the fibres are used in the boiler as fuel.

A computer model is the algorithms and equations used to capture the behavior of the system being modeled. By contrast, computer simulation is the actual running of the program that contains these equations or algorithms. Simulation, therefore, is the process of running a model. Thus one would not "build a simulation"; instead, one would "build a model", and then either "run the model" or equivalently "run a simulation Without its software, a computer is basically a useless lump of metal. With its software, a computer can store, process, and retrieve information, find spelling errors in manuscripts, play adventure, and engage in many other valuable activities.

Computer software can be roughly divided into two kinds: the system program, which managethe operation of the computer itself and the application programs, which solves problems for their users. Themost fundamental of all the system programs is the operating system, which controls all the computer's resources and provides the base upon which the application programs can be written. In general, all the programminglanguages are softwares but all the softwares are not programming languages.

CONCLUSION

Computer simulations are used to study the dynamic behavior of objects or systems in response toconditions that cannot be easily or safely applied in real life. In order to produce good models that canbe used to produce realistic results, these are the necessary steps that need to be taken in order to ensure that simulation models are functioning properly. Simulation models can be used as a tool to verify engineering theories, but they are only valid if calibrated properly. Once satisfactory estimates of the parameters for all models have been obtained, the models must be checked to assure that they adequately perform the intended functions. Extracting and expression of oil from oil seeds involve a wide range of traditional, chemical and mechanical processes. Extraction of oil from palm kernels is such an important aspect of palm kernel processing, and as the palm oil production stages in the processing line had undergone a great deal of mechanical development, the palm kernel oil production is still less mechanized and this production process actually begin with the separation of the palm nuts from thefibre. Capacity building means planning for people to acquire knowledge and advanced skills that arecritical to a country’s economic growth, its standard of living and individual. It is the planned programmesthat will impart skills which will enable the recipient put the knowledge and skills acquired into productive uses tosolve wide range of individual and national problems.

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