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Smart Patient Monitoring Wireless Robot

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Abstract: *This paper report the methods for analysing, designing, improving and controlling the health care management system. Smart Robots can perform and wish for tasks in any type of environment without the continuous instruction of human. A line assistant robot is automated device programmed to follow a specific path. A line following robot carries the medicine to the patient whenever they need it based on the predefined path that can be either visible on a black line on a white surface or vice-versa. An IR sensor remote is used by the sister or electrician, based on which the data is sent to the system or the robot. In this algorithm Firebird V microcontrollers are used to deliver the requested provisions by the patients in the hospital. It uses three levels of feedback for path alignment, rotation offset and for avoiding obstacles. Since the path of the wards remains same in the hospitals, so a fixed path is defined and is loaded to the Firebird V through codes. In this project the robot used is Firebird V ATMEGA 2560.*

Keywords: Line follower robot, Firebird V ATMEGA 2560 Microcontroller, Autonomous Intelligent Robots

I. INTRODUCTION

In this project, COVID 19 centre monitoring and management system has been proposed and integration of different sensor with Controller. The sensors implemented can communicate with data collection and processing unit. Therefore work aimed to propose COVID 19 centre management with microcontroller based approach to handle medical services and patient monitoring and treatment work flow. In the experimented model, Atmega controller, MAX30100 Pulse Oximeter Sensor and temperature sensor (DHT11) are integrated. A system has capability to monitor and control COVID 19 centre services and patient monitoring via remote connection. It is evaluated with temperature sensors connected to measure temperature of patients. In addition, when patient get fever more than regular value, an alert was sent to authority in a quick time. After results, it is indicated that the developed system has effective potential to work in pandemic situation and has technological flexibility. The benefits of implemented research methods are useful in digital health management in pandemic scenario.

II. LITERATURE SURVEY

Homera Durani and Mitul Sheth proposes that node ESP8266 unit used for various home applications with server based system. Home application handled/controlled by mobile user internet [2]. In this paper monitoring for system works on the wireless communication and observation of running data shown in app blynk. Various objects are wireless connected with network such as Internet of Things (IoT). Wi-Fi communication layer links for home application are used. Raspberry pi store the data and send to the application user on request [2].

D.Shiva Rama Krishnan and Subhash Chand Gupta investigated that orientation of wireless-sensing node system. This project explains about unexpected death rate through patient health monitoring system to communicate the problems. Temperature and heartbeat sensor are used to collect the patient health data and arduino-uno are used to the sensors [3]. In case of sudden changes data are sent to the Internet of Things (IoT). The given system was utilized for home use through patient which is not in serious conditions but depends on timely detected through doctor or family. Within a much minimum time the results for ECG, blood pressure and temperature are monitored by health monitoring system [3].

Peerasak Serikul, Nuttapun Nakpong and Nitigan Nakjuatong proposed that the controlling and monitoring the things with network via internet. The modern technology used for farming which gives better performance in productivity and quality. Node MCU ESP8266 and SHT21 humidity sensor was used to send data to blynk [4]. While code generated with the help of Arduino IDE. Peoples are connected through the technology such as Internet of Things (IoT) which allows communication and data exchange. The author conclude that IoT technology should use for humidity monitoring of paddy

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bags which are stored inside the warehouse using smart capsules. The result shown that blynk application server could store the data from humidity sensor present inside the paddy bags [4].

III. Work Objectives

- To Operate Robot wirelessly.
- To develop wireless operated robot.
- To measure temperature of patient .
- To measure oxygen level of patient .
- To dispense tablet from the dispenser box.

IV. Methodology of Design and Analysis

A parameter study is done to evaluate the most crucial parameters for FE analysis of axial ball bearings. The parameters that are evaluated are mesh density, contact stiffness, osculation, load level, geometrical nonlinearity and material nonlinearity. The studies are performed by means of the FE software Ansys. The accuracy of finite element analysis depends on different parameters such as element type, boundary condition and how the loads are applied etc. Therefore the FE model is nothing else but an approximate realization of the reality. The parameter study can be done by physical tests. However it will increase the cost, time and resources consumed and therefore FE analysis is more suitable choice, at least for parameter evaluation.

4.1 Theoretical aspects of the work

In this study the finite element method is adopted using Pro Engineer and Ansys as a commercial CAD and FE program. The following chapter contains some fundamentals of the applied theories provided that the reader has an initial knowledge of basic structural mechanics, machine components, and fundamentals of the finite element method.

4.2 Finite element method

Finite element method (FEM) is a method for approximate solutions of partial differential equations. The domain of interest is divided into finite elements on which the solution is approximated by piecewise-polynomials. The finer the partition (Mesh) is, the more accurate the solution.

4.3 Nonlinear Analysis

Nonlinear analysis is used when a structure behaves nonlinear when loaded i.e. the deformation and the stress state does not have a linear relation to the applied load. The three main sources to nonlinear behaviors are: contact, geometric nonlinearities and material nonlinearities. In order to manage such calculations with a linear process the Newton Raphson method can be used

4.4 Newton-Raphson method

Newton-Raphson is an iterative method for finding solution to nonlinear equations and equation systems. In FE calculations the method is used for non-linear problems and the relations between force and displacement is shown in Figure 2.1 for one degree of freedom. The procedure for Newton-Raphson method is as follows: The load is applied and the displacements are calculated. From the displacements new conditions are calculated and the displacements are recalculated. This procedure is repeated until the solution is converged i.e. reach a certain value or level.

4.5 The iterative procedure is as follows:

A. Material Nonlinearities

A nonlinear stress-strain relationship results in a nonlinear behavior. Plasticity is a nonlinear stress-strain relationship as shown in Figure. Definition of Plasticity according Ansys (2007) is: “When a ductile material experiences stresses beyond the elastic limit, it will yield, acquiring large permanent deformations.”

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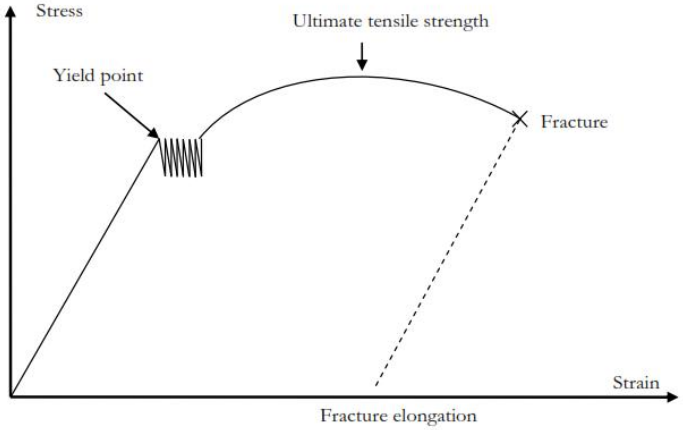

Figure: Relationship Between Stress & Strain

4.6 Ansys

Ansys is a commercial, general purpose FE software which has been on the market since 1971. It can be used in several applications for example to study the thermal heat flow, fluid flow, magnetic fields, acoustics/vibrations and last but not least structural mechanical problems.

A. Contact in Ansys

A handful of ways to handle contact are available in Ansys. However, the one described here is penalty based contact since it provides short calculation times and therefore is used.

B. Penalty based contact

When a penalty-based contact is used, Ansys adds a spring coefficient (k factor) when two surfaces come in contact with each other, in order to prevent penetration and to transfer load. (Figure) However penetration will occur in order to transfer force, which is not the case in reality. Therefore the penalty-based methods are sensitive to the choice of the spring coefficient. The spring coefficient Ansys uses during calculations is the product between the "normal stiffness factor" specified by the user and a reference factor calculated by the program. An additional aspect (apart from the accuracy) to consider when selecting the "normal stiffness factor" is the convergence behaviour. A stiffer contact will result in more calculation iterations, since bouncing might occur.

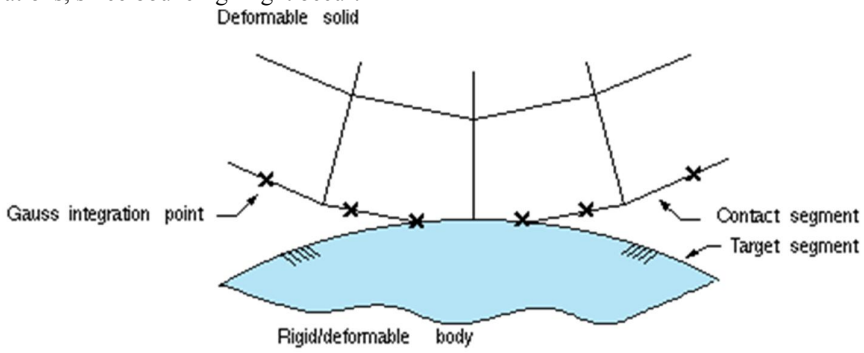

Figure: Contact Stiffness

C. Asymmetric Behavior

A contact condition can be either symmetric or asymmetric. When the contact condition is symmetric none of the surfaces can penetrate each other, while when the contact is specified as being asymmetric only one of the surfaces is prevented from penetrating the other i.e. the contact surface cannot penetrate the target surface but the opposite is possible. Figure illustrates the importance of selecting the correct contact pair.

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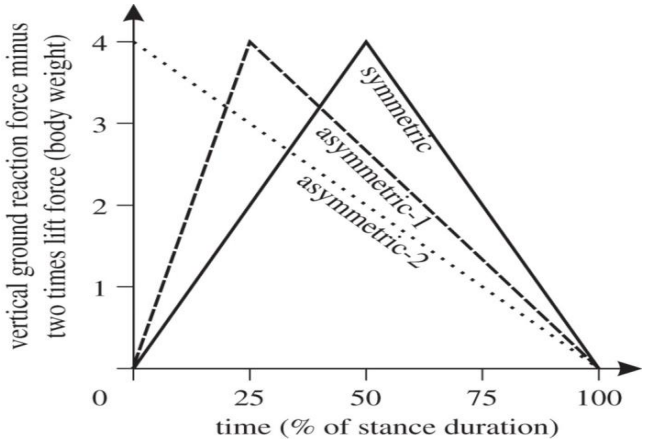


Figure: Asymmetric behaviour

D. Bilinear Stress-Strain Curve

In context of the license version used, Ansys tender a bilinear approximation of the stress-strain relationship as in figure. The bilinear stress-strain curve requires two input values, yield strength and tangent modulus. The yield strength is the value when plastics straining occurs and the tangent modulus is the slope of the stress-strain curve after yielding.

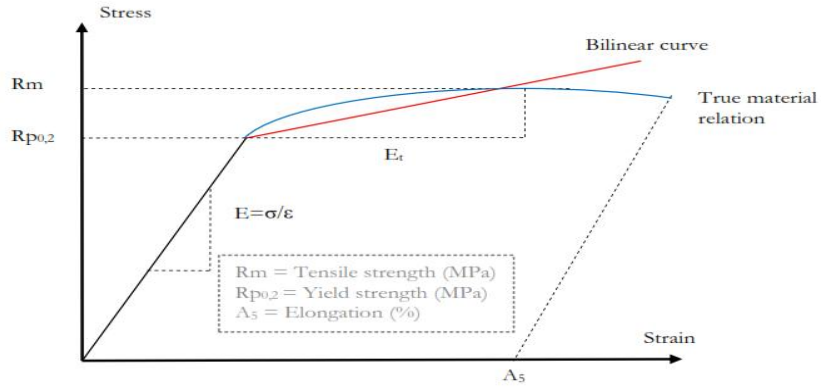


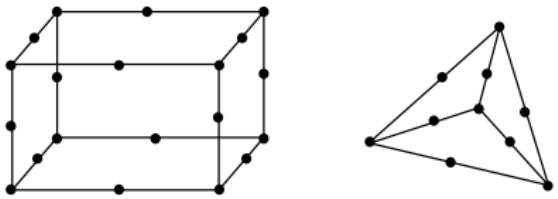
Figure: Relationship Between Stress & strain, Bilinear curve in Red & True Material Relation in blue

E. Meshing Controls

Ansys offers several tools to control the meshing procedure. The mesh densities of the whole model can be controlled by global settings for relevance centre in three steps: coarse, medium or fine.

F. Method

Method is a meshing control that provides the possibility to select different elements shapes. The different elements that are available are: tetrahedron or quadrilateral. Tetrahedron elements are triangular pyramid like elements with 10 or 4 nodes and quadrilateral elements are cube elements with 20 or 8 nodes.



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G. Sizing

Sizing is a meshing control that provides the possibility to mesh with different mesh densities at selected regions. By meshing fine in the area of interest and using coarse mesh in the remaining parts one is able to reduce CPU time and memory usage. There are a couple of ways to select the region of a sizing control available in Ansys. The region can be a surface. This will produce a fine mesh (or actually a mesh with the size specified) on the surface only. The region can also be an entire body which will produce a fine mesh all over the body. If a contact region is to be analysed, Ansys offers the possibility to specify the mesh size in the contact region. And to capture a local behaviour it is possible to specify a so called *sphere of influence* which makes it possible to set the element size (mesh size) within the volume of a sphere. The sphere of influence can be used to enclose both faces and bodies.

IV. RESULT

It has a very good organization level due to the use of putting right computation.

4.1 Advantages

1. Robot never worn out.
2. We do not need to pay.
3. It will always obey the orders.
4. It will never be late for any of the work given.
5. Easy to use and works faster.

4.2 Limitations

1. The robot does not wait-upon on prime concern.
2. We cannot monitor the battery.
3. Requires high cost maintenance.

4.3 Applications

1. 24x7 Patient monitoring can be done .
2. Infection of doctors can be minimized.
3. Robot can be utilized for material handling such as water, Food, Medicine etc.

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