CHAPTER 59

TECHNOLOGY MANUFACTURING PROCESSES & AUTOMATION ENGINEERING

Doctoral Thesis

01. MANRAL (Ankit)
Studies on Geometrically Different Natural Fiber Mats Reinforced Green Composites.
Supervisor : Dr. Pramendra Kumar Bajpai
Th 25538

Abstract
(Verified)

Depletion of petroleum products and its adverse effect on the environment has paved the path for green composites. Higher specific strength, biodegradability and thermal insulation are some of the favourable properties that make green composites widely accepted. These composites are commonly fabricated by utilizing a wide range of natural fiber along with biopolymers including bio-based thermoset resins (bio-based epoxy) and thermoplastic polymers. These natural based constituents are fully degradable in nature after a composite's service life and makes it a favourable material over synthetic fiber polymer composites. Nowadays' natural fiber reinforced composites are being used in automobile and household's applications due to its better mechanical properties, less weight and inexpensiveness. PLA is a very popular biopolymer that is used as a matrix material in various types of natural fiber composites. In the present research investigation, three kenaffiber mats (Unidirectional, Bidirectional and Randomly oriented) are treated with sodium acetate and reinforced with polylactic acid for the development of composites using compression molding. Standard test procedures were used for evaluating the static (tensile, flexural and impact) and dynamic mechanical properties (DMA) of developed composites. Effects of fiber mat type and treatment of kenaffiber on mechanical properties of developed composites were studied. The surface morphology of fractured samples was analyzed by scanning electron microscopy. The degradation study of the untreated and treated composites was carried out using soil burial (agricultural and compost soil) and water absorption test at room temperature. The thermal conductivity was measured in the lateral directional of the samples while the acoustic behavior of the developed green composites was experimentally investigated using an in house developed impedance tube. Sound at varying frequencies was utilized as an input parameter. The type of kenaf mats and fiber chemical treatment influenced the acoustic behavior of developed composites.

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PLA green composites 8. Summary, conclusion and scope for future work. References.List of publications.

02. SINGLA (Rohit)
Investigation of Dynamics and Control Techniques for Master-Slave Robot Tracking.
Supervisors : Prof. Vijyant Agarwal and Prof. Harish Parthasarathy
Th 25165

Abstract
(Not Verified)

Teleoperation technology allows us to remotely operate robotic (slave) systems located in hazardous, risky, and distant environments. The human operator sends commands through the controller (master) system to execute the tasks from a distance. In the application of teleoperation, the slave acts in the environment and its resulting position and velocity are fed back to the master end. The master moves accordingly with this feedback in addition to a human operator force acting on it. The slave reads the master position and velocity and the resulting error is fed back to the slave robot. Thus, the master gets to know about the environment in which the slave moves, and he controls the slave accordingly via the feedback. Since teleoperation deals with systems controlled from a distance, time delays and package losses in transmission of information are present. These communication failures affect the human perception and system stability, and thus, the ability of operator to handle the task successfully.This thesis broadly investigates related critical issues on master-slave teleoperation system beginning with analysis of control of just a single robot. One, developing a dynamical theory of 2-link robots in the presence of noise arising from environmental effects and human tremor using Ito's theory of stochastic differential equations. This theory enables us to take parametric uncertainties into account and evolve parametric estimates according to iterative schemes described once again by stochastic differential equations. The stability of the stochastic tracking error and stochastic parametric evolution is in this theory investigated by applying the Ito differential rule to an appropriately constructed Lyapunov function of the tracking error and parametric estimation error. Robustness and sensitivity analysis of tracking error energy with respect to parameter fluctuations are also investigated. Later, Brownian motion as process noise is replaced by Levy processes.

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